BUTANE-PROPANE News

25¢

I'm Feeding Two War Workers

MY DAUGHTER'S a welder... my husband makes airplane parts. And *my* job is to keep them well-fed and fit to carry on *their* jobs. It's not so easy these days, with rationing and scarcities. But my Grand Range helps to make my war job so much easier.

Those Econo-Speed Burners are marvels . . . they cook things just right so there's no wasted or spoiled foods in *our* house. And they use so little gas . . . I call my Grand my private "gas-rationer."

I'm so glad we got a Grand to start with, because it's proving itself every day under constant service. When we're finally ready for a new range, I'll never be satisfied with anything but another Grand.

WHEN PEACE COMES
...IT WILL BE GRAND

Grand GAS AND ELECTRIC *Ranges*

DIVISION OF THE CLEVELAND COOPERATIVE STOVE COMPANY
CLEVELAND, OHIO

MARCH 1943

He gets his second breath from a deep-drawn cylinder

The oxygen cylinder shown below is another example of the way the Hackney deep-drawing process is conserving materials, man-hours and equipment—and is producing improved products.

High above the clouds, deep-drawn cylinders containing oxygen aid pilots to breathe easily. To meet necessarily stringent requirements, cylinders must be light in weight and have high tensile strength.

For Now It's War—

And products like the one described above keep rolling out of Pressed Steel Tank Company's factory. Today, all of Hackney's facilities are pledged to the making of products for Victory. However, we continue to learn new things every day—uncover new knowledge—and all this experience and research will be put to work for you . . .

When Victory Comes

Then we'll be able to turn our energies toward the making of instruments of peace. Hackney will again be the source for L-P Gas Cylinders which are durable in service—light in weight—long lasting—low in maintenance cost . . . preferred throughout the industry.

Pressed Steel Tank Company

GENERAL OFFICES AND FACTORY · 1487 SOUTH 66th STREET

Milwaukee, Wisconsin

CONTAINERS FOR GASES, LIQUIDS AND SOLIDS

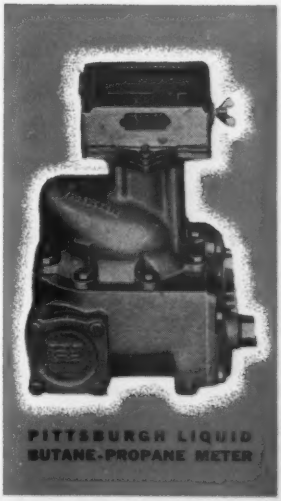
CONSERVE AS YOU SERVE!

with

PITTSBURGH *Liquid* BUTANE-PROPANE METERS

CONSERVATION of war strategic materials is the patriotic duty of every American. Conservation of butane and propane, plus conservation of the rubber and gasoline needed in its distribution to consumers, is being effectively accomplished through truck dispensing by meter measure. Hundreds of distributors are relying on Pittsburgh Liquid Butane-Propane Meters to aid in efficiently scheduling deliveries, to catch leaks, and to safeguard customer goodwill.

The Pittsburgh Equitable Meter Company manufactures the only complete line of meter equipment for LPG. Whether in liquid or gaseous state, there is a "Pittsburgh" or "EMCO" Meter properly designed to handle the service accurately and economically.


PITTSBURGH LIQUID BUTANE-PROPANE METER

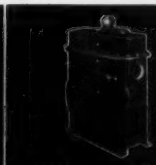
PITTSBURGH EQUITABLE METER COMPANY

NEW YORK · OAKLAND · BROOKLYN · TULSA · KEARNEY · CHICAGO · HOUSTON · BOSTON

MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.
NATIONAL METER DIVISION, Brooklyn, N. Y.

KANSAS CITY · SEATTLE · PITTSBURGH · HOUSTON · SAN FRANCISCO · COLUMBIA · LOS ANGELES · BUFFALO

Butane Propane Liquid Meter


EMCO Large Capacity Pressed Steel Gas Meter

EMCO Type "B" Ejector Service Regulator

ROTOCYCLE Meter for Liquid Butane – Propane

NORDSTROM Lubricated Plug Valve

BUTANE-PROPANE *News*

Reg. U. S. Pat. Off.

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Landships . . . Bound For Their
Port O' Call On time
Anchorgas
Anchorgas
BUTANE—PROPANE
ANCHOR
Petroleum Company
Tulsa, Oklahoma

LETTERS

Gentlemen:

We have a problem and we hope that you may give us some light.

We own about 200 bottled gas bottles and at present we are using our pump on our butane trucks to fill these drums with propane. At times, however, the trucks are not in town and we need bottles filled. Is it possible to use a compressor taken from some piston type refrigerator and work it over to make a pump that will pump propane? These compressors fill through the crank case and the gas flows into the head through a flapper valve in the top of the piston. Will this system work and if so will the system lubricate sufficiently for use with propane?

M. H.

Kansas

Usually attempts to change over such equipment have not proven satisfactory. To give you a definite answer on any specific equipment, we would have to know the details of the change-over that you expected to make. Lubrication is a big problem in such matters, as you evidently know by your letter.

We suggest that before you attempt any change-over, you contact advertisers in BUTANE-PROPANE *News* who build and sell vapor differential pumps for the specific job you have in mind. These companies are Brunner Manufacturing Company, Utica, N. Y., and L. C. Roney, Inc., 1740 West 59th St., Los Angeles. —Ed.

•

Gentlemen:

Somewhere in some publication I saw an article covering the subject of the cause of fires. In this article was a list showing gas to be just about the least cause of fire. Do you have this information, or can you tell me where I can probably find it? I shall appreciate it greatly if you can help me out.

H. G. K.

Michigan

Upon Page 25 of the February issue of BUTANE-PROPANE *News* will be found a short story including a tabulation of the causes of fires. This shows gas and gas appliances at the bottom of the list.—Ed.

•

Gentlemen:

Please send me the name and address of a reliable manufacturer of propane gas incubators and brooders.

E. J. G.

Wisconsin

We are pleased to give you the following names of manufacturers of brooding equipment that can be used with propane gas:

A. R. Wood Manufacturing Co., La Verne, Minn., and Santa Cruz, Calif.; W. H. Hart Manufacturing Co., P. O. Box 56, Station A, Los Angeles, and The Oaks Manufacturing Co., Tipton, Ind.—Ed.

•

Gentlemen:

We would appreciate some information pertaining to unloading tank cars of propane as regards the value of gas left in the car. For instance, assume all liquid is withdrawn from tank car and vapor pressure reduced to 40 lbs. per sq. in. before returning car; what amount of gas is lost (temperature basis 80° F)?

Assume 25 lbs. and 20 lbs. and 15 lbs. per sq. in. pressure as the status in tank car before sealing for return of car. What gas is lost in gallons? What formula would you use?

Assume these factors in the computation:

10,000 (to 12,000) gal. tank car

Product:—propane (C_3H_8)
Temp.:—average 75° to 80°F. and 85°F.
Compressor used to facilitate unloading.

B.M.

Florida

Assume the capacity of the car to be 10,000 gallons, temperature of vapor 80° F., pressure of vapor left in car at 40 lbs. per sq. in. gage. First convert volume of car to cubic feet:

10,000 gals. × .1337 cu. ft./gal. = 1337 cu. ft.

Convert gage pressure to absolute pressure.

40 lbs. per sq. in. + 14.7 lbs. per sq. in. = 54.7 lbs. per sq. in. absolute.

Divide the absolute pressure by 14.7 lbs. per sq. in. to obtain the number of compressions the gas is under:

$$\frac{54.7}{14.7} = 3.72 \text{ compressions.}$$

Multiply the volume of the car by the number of compressions to determine number of cubic feet of gas at atmospheric pressure:

1337 × 3.72 = 4970 cu. ft. at 14.7 lbs. per sq. in. (1 atmosphere) and 80° F.

To correct for temperatures at 60° F., the base temperature used in the tables, add the observed temperature to 460:

80° F. + 460° F. = 540° F. Absolute Temperature Observed.

60° F. + 460° F. = 520° F. Absolute Temperature Base.

Divide the Base Temperature by the Observed Temperature for correction factor.

$$\frac{520}{540} = .962$$

Multiply the cubic feet at observed temperature by the correction factor to obtain the number of cubic feet at 60° F.

.962 × 4970 = 4780 cu. ft. at 60° F. and 14.7 lbs. per sq. in. absolute.

From the tables 36.45 cu. ft. of propane at 60° F. and 14.7 lbs. per sq. in. absolute equals one gallon.

$$\text{Therefore } \frac{4780}{36.45} = 131 \text{ gallons left in car.}$$

The above steps can be reduced to the following formula: Q =

$$C \times .1337 \times \frac{(P+14.7)}{(14.7)} \times \frac{(520)}{(T+460)} \times \frac{1}{\text{cu.ft.gal.}}$$

When

C = Gross capacity of car in gallons.
P = Pressure in lbs. per sq. in. gage of the residue gas.
Q = Quantity of residue in gallons.
T = Temperature in °F. of the residue gas.

By substituting the number of cubic feet per gallon, the liquid contents of any mixture can be obtained.

As all conditions remain the same except the pressure, the answer to the second part of your letter, namely the volume at 25 lbs. per sq. in. gage, 20 lbs. per sq. in. gage, and 15 lbs. per sq. in. gage will be in direct proportion to the absolute pressures.

$$\frac{25+14.7}{54.7} \times 131 = 95 \text{ gal.}$$

$$\frac{20+14.7}{54.7} \times 131 = 83 \text{ gal.}$$

$$\frac{15+14.7}{54.7} \times 131 = 71 \text{ gal.}$$

Does this solve your problem?—Ed.

•

Gentlemen:

Many times in the past I have seen ads in your paper advertising special carburetors for the use of butane and butane and propane mixtures. As I am not actively in the business now, I do not have a copy of your paper and I would very much appreciate the name of the manufacturers of these carbureters for both trucks and pleasure cars. We used to run a fleet of trucks on butane and I know that such is available in the far West and part of the Midwest.

Please send me the names and addresses of the manufacturers of all the necessary equipment, who have advertised with you in the past.

P. M. T.

Massachusetts

Names of manufacturers of equipment for changing over gasoline engines to butane are: American Liquid Gas Corp., 1109 Santa Fe Ave., Los Angeles; Ensign Carburetor Co., 7010 South Alameda St., Huntington Park, Calif., and Roadmaster Products Co., 2316 South Flower St., Los Angeles.—Ed.

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• **BUTANE-PROPANE *News* welcomes letters from our readers, but it must be understood that this magazine does not necessarily concur in opinions expressed.—Editor.**

HAROLD W. SMITH
Guest Editor for March

For War Now—Peace Later

By HAROLD W. SMITH
President, American Liquid Gas Corporation, Los Angeles, Calif.

HIGH on the list of reasons why we shall win this war is the imaginative leadership we are getting from our business and industrial executives, combined with the brilliance of our engineers and technicians who are devising and establishing countless methods to speed production and improve its quality.

And it is this type of executive and technical mind which today holds out a tremendous opportunity to the liquefied petroleum gas industry. These men want production and more production—and if we can show them how liquefied petroleum gas will increase production, they will give us action.

Here in the west, in particular, executives and engineers in their search for new methods have seized upon the liquefied petroleum gas standby plant as a "must" installation. They have used these installations to insure a constant gas supply through any and all emergencies—thus insuring constant production. They have used such gas standby plants to reduce operating costs. And they have used these installations to supply fuel to industrial plants in remote suburbs, desert or mountain regions where piped gas service was not available.

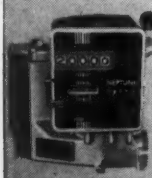
War-time industry is discovering that liquefied petroleum gas is one of the most flexible of the petroleum products. They now recognize that it renders many services, often giving superior results to those obtained from fuel oil, gasoline and natural gas.

Our fuel is now being widely used to service portable crucibles, plumber pots, driers, forges, and for metal cutting, riveting and kindred uses. It is firing kilns, ovens and furnaces in countless war plants.

And this is but the beginning. For the duration, we shall see LP-Gas men working side by side with war plant executives and engineers to achieve increased and more efficient production. Then—having proved ourselves under the fire of war—will come our opportunity to serve peace-time industry on a scope only dreamed of a few short months ago.

Quietly proving themselves

Edwards Gas Appliance Co., San Antonio, Tex., keeps its Red Seal LP-Gas metering equipment steadily on the job — giving "customer satisfaction.



ALL IN ONE!

Red Seal Compact Type LP-Gas Meter (for tank truck use) combines — in one complete space-saving unit — all equipment necessary for accurate metering. Print-O-Meter Register shown.

RED SEAL LIQUID LP-GAS METERS... with their basically correct design and simplicity of construction . . . have been quietly proving themselves during the years. And now, in the present period of severe wartime stress, their stamina and maintained accuracy have won the unrestrained approval of LP-Gas marketers.

Meter types and sizes for plant or tank truck use...on butane or butane-propane mixtures. Direct-reading or round dial registers. (Bulletin 685)

NEPTUNE RED SEAL METERS

NEPTUNE METER COMPANY

Main Office: 50 West 50th Street, New York. Branch Offices at Atlanta, Boston, Chicago, Dallas, Denver, Kansas City (Mo.), Los Angeles, Louisville, Philadelphia, Portland (Ore.), San Francisco, and Long Branch, Ont., Canada.

GASOLINE DISPENSING PUMPS • METERS FOR: BARGE AND TANK CAR UNLOADINGS • STORAGE TRANSFERS • LOADING RACKS • DELIVERY TANK TRUCKS

1990

MAINLY BEYOND THE MAINS

By ELLIOTT TAYLOR, Washington Editor

The Month

Tank cars that have been hauling LP-Gas for the normal market are on their way now into the service of butadiene for the synthetic rubber program. To increase the total effective carrying capacity of the cars that are allowed to remain on LP-Gas, PAW will shortly issue through ODT new orders designed to cut the average round trip time per car from the present eleven and three-quarter days, and will shoot at a goal of ten days per round trip per car, or three turnarounds per month. Many of the rather liberal exceptions that were granted to ODT's order prohibiting the hauling of gas in tank cars for runs of less than 200 miles will be revoked; there will be a tightening up on cross-haul prohibitions and efforts will be made to increase the proportion of total plant and refinery output hauled by tank truck.

ELLIOTT TAYLOR

While the industry in general has cooperated heartily in the program to effect the greatest utilization of tank cars, there are occasional cases in which refiners and producers have been slow to inaugurate plans of their own to free tank cars from LP-Gas service through the use of trucks. Perhaps the principle reason for this reluctance to make the inevitable change in transportation methods, is the shortage of storage facilities which can be alleviated in a measure by sending gas on leisurely and circuitous short hauls while the receiving storage tanks are being emptied.

Since more trucks will be required as the transition from rail to highway borne transportation is effected, we believe that now is the time for distributors who need additional tank trucking facilities to put in their applications with ODT and with the WPB for the necessary units. There is every indication that such applications, when properly supported by data on the necessity for the new equipment will be given speedy consideration. The Transportation Division of PAW, working closely with both ODT and WPB, has shown a disposition to follow through on any requests designed to expedite the movement of petroleum

products. As a result prompt decisions are now the rule rather than the exception.

It is important to note that the ability of the LP-Gas industry to solve its transportation problems during the coming year, and thereafter as long as the war lasts, will have to rest to a large extent on the action of the members of the industry in anticipating and applying for the necessary tank trucks to handle increased loads, and to replace railroad rolling stock withdrawn from the service. At the present time no agency in Washington has been able to originate or sponsor a truck program for butane and propane. This is true because of the meager amount of information that is now available on just how many trucks are in service, the number of these that are owned by contract carriers, the proportion of the total industry fleet that can legally and economically operate in other than their present territories, and the location and intentions of possible buyers of tank trucks for this service.

The procedure to be followed in making application for a tank truck or trailer is simple but it must be completed in every detail if quick action is expected. The first step is to develop a detailed and comprehensive statement of the necessity of the movement by the method to be employed. This should show how the applicant proposes to use his new equipment, and why no other method of hauling can be considered feasible. No pertinent information should be omitted, as many requests have been delayed or refused because the application assumed that war agency processors would understand the details of the applicant's operations.

The first step having been completed, the applicant should file simultaneously requests with ODT for the chassis and power unit, and with WPB on a PD-1A for the necessary steel and fittings. And while it is not required, we would also recommend that copies of the applications and of the supporting data be sent to the Transportation Division of the PAW. This agency combines an understanding of the problems involved in natural gas and liquefied gas operations with the influence necessary to see legitimate requests through to successful action.

* * *

Surveys

Announcement through the medium of a drygoods magazine that the advertising and sales promotion committee of the Liquefied Petroleum Gas Association will conduct a "study of customer attitudes" preparatory to the first national advertising campaign of the association, finds us skeptical of the value of any such campaign under wartime conditions. As for the advisability of a study of customer attitudes, we offer for what it is worth, our opinion that the attitude of most LP-Gas custom-

ers is that they don't want to be surveyed by anybody on any subject so long as the government forms keep rolling in for their attention.

Certainly the subject of postwar planning is one worthy of the attention of this industry, but the blunt truth is that this nation is in a tight spot right now, and the old customer survey standby has too much of a business-as-usual aspect about it to be favorably received by those who realize that fact. We believe it should be left on ice where it was put by the directors of the LPGA a year ago, and taken out for reconsideration about the time we begin to see coffee and butter and silk stockings and shoes beckoning coyly from the shop windows, and we can drive up to the gas pumps in our new model Superduper and say "fill 'er up Buddy" (not Babe)!

* * *

Our comments have been invited to clear up a slight misunderstanding that exists in some quarters regarding the extension of preference ratings for the purchase of capital equipment for LP-Gas dealers. On a defense plant or a defense housing job, for example, with an AA-3 or similar rating some dealers have attempted to extend the contractor's rating for the purchase of cylinders or other installation equipment. The proper procedure is to file with the WPB on a PD-397 form for permission to make the installation, upon the granting of which a PD-1A should be filed if equipment not already in stock is required to do the job.

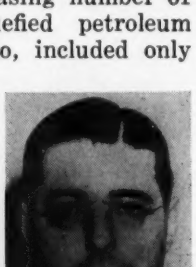
* * *

The announcement by WPB late in January that J. A. Krug, one time head of WPB Power Branch, has been appointed Director of the Office of War Utilities, with authority over natural and manufactured gas as well as other public utilities would seem to indicate that the transfer of jurisdiction over natural gas from WPB to PAW is not under consideration for the immediate future. It does not preclude, however, the possibility that at some early date the offices and the personnel of the LP-Gas Unit of WPB may be picked up and set down within the authority of the Petroleum Administrator. We have on previous occasions delineated in some detail the arguments in favor of such a move, and we are confident that its desirability as a contribution to more effective participation of the industry in the war program will one day be recognized. There already exists in PAW all of the basic authority that would be necessary to administer a sound LP-Gas program, integrated as it of necessity must be, with the programs of other fuel supplying industries. And of even greater importance is the fact that there also exists in PAW the industry knowledge necessary to originate and plan such a program.

PROPANE ON THE AIRLANES

By ALBERT A. ARNHYM
Chief Engineer, Pacific-Airmax Corporation, Los Angeles

THE ever increasing number of uses for liquefied petroleum gases has, hitherto, included only installations on the ground and in boats. Now one member of the family, propane, has taken to the air and for no less a purpose than to heat airplanes.



A. A. ARNHYM

While the use of propane to supply heat in flight is new, propane stoves have been employed for quite some time to pre-heat airplane engines on the ground. The warm-up period required to render a stone-cold airplane engine safe for the take-off is often quite annoying and costly. In military operations such a period is even dangerous as it prevents aircraft, which has been standing on a cold emergency field for some hours, from taking off fast enough to meet approaching enemy planes in the air.

The purpose of the propane stoves is, therefore, to shorten or even eliminate the warm-up period and thus not only keep the plane in readiness for immediate take-off but also conserve precious aviation gasoline and decrease engine wear. These stoves are wheeled to the plane and provided with a flexible hot-air duct which is inserted into the engine nacelle. Fuel is supplied from conventional cylinders which are mounted on wheels, together with the heater.

The design of the stoves is only little different from that used in other and similar applications. Unfortunately, it is not possible to employ a heater of this type on an airplane without resorting to entirely new principles. This becomes obvious, if it is realized that the air required for combustion decreases rapidly in density with increase in altitude, and that the requirements of safety, control and serviceability on an airplane are quite different from those on the ground.

Requirements of Aircraft Heating

The importance of aircraft heating is not always fully recognized. Not so many years ago flying was merely a sport and adventure which would have lost its thrill if such parlor comforts as heaters would have been part of the meager accessory equipment. Furthermore, the duration of flights in those days, the altitudes reached and the weather conditions at which flights were undertaken permitted warm clothing for the pilot to be the only means for keeping from freezing.

With the advent of commercial flying the requirements for comfort were suddenly brought into the

foreground. The airline operators realized soon that they would be unable to attract regular passengers unless they provided a certain amount of comfort which was not less elaborate than that on comparable ground conveyances. This resulted in the creation of the art of "comfortization," that is, the provision of such equipment as is necessary to minimize or eliminate the manifold discomforts inherent to flying. One of the most objectionable discomforts proved to be the low temperatures at altitude which compelled the airlines to look around for suitable heating systems.

This developed into a much more difficult task than was originally anticipated. In addition, the heat requirements very rapidly increased when it became necessary to add the comforts of hot water supply and the serving of warm food. The problems of heat supply were further aggravated by the increase in range, speed and altitude which created numerous new requirements for the then existing heating systems, although they did not even suffice for the minimum needs of cabin heating.

Military Requirements Severe

The latest and most difficult requirements were added as a consequence of the experiences by military flight crews during this war. At the altitudes and speeds at which modern military aircraft fly, the temperatures are so low that, for instance, the inflatable rubber boots along the leading edges of wings and control surfaces do not suffice for "de-icing"—the removal of ice formations. For this reason it has become necessary to duct warm air through the wings in order to prevent the dangerous formation of ice altogether. This method is called "anti-icing" and, while it is the most effective method known to date, it requires tremendous heat quantities.

Heat Eliminates Condensate

Another treacherous enemy of the military flier which can be best defeated by heat is the condensate which forms on windshields, portholes, gun-sights, bomb-sights, lenses, etc. Finally, there are numerous accessories which must be heated to keep them operative or from failing. Among those are gun breeches, storage batteries, photographic equipment and even ammunition. Heating of the latter has proven necessary where condensation on shells froze and caused their explosion within the gun barrels.

While these conditions exist primarily for the military plane, there is little doubt that, after the war, commercial planes will fly at altitudes and under conditions which had been considered impossible only a few years ago. This will result in requirements for anti-icing, anti-frosting and heating of accessories which are very much above the outputs of a conventional heating system. The present estimates for a complete heating job on a four-motored transport range anywhere from one to two million B.t.u. per hour.

The heat quantities needed for cabin heating depend, of course, on the size of the plane, its service

ceiling, speed, amount of heat-insulation, rate of air changes, minimum specified outside temperature and many other factors. A small, cockpit type of airplane requires about 10,000 B.t.u. per hour, per person. A medium sized bomber may need from 80,000 to 100,000 B.t.u. per hour total. Large transports have proven to require up to 250,000 B.t.u. per hour for cabin heating alone. Accessories are usually heated by unit heaters of about 10,000 B.t.u. per hour output.

Design Considerations

From the above it is evident that aircraft heating entails more than keeping the feet of a pilot warm. It also shows that the required heat quantities alone present a tremendous problem. However, even more complicating are the conditions under which this vast quantity of heat must be provided.

Fig. 1 shows a graph of temperatures at various altitudes. As can be seen, both summer and winter temperatures become the same at about 40,000 ft. altitude and remain constant from there on at 67° F. below zero. However, these figures are merely theoretical averages, and much lower temperatures at lesser altitudes have been experienced by military flight crews. British fliers have even reported temperatures as low as minus 100° F. Apart from the amount of heat needed for such extremes, it is very difficult to find materials and design apparatus which will operate at temperatures as low as that.

Among other problems of building aircraft heaters and, for that matter, accessories which will stand up under all conditions of flying, are the high gravitational forces which are exerted in banking and diving of fast-flying planes. While the "black-outs" of pilots, pulling out from dive-bombing, have been widely discussed, it is less known that the same forces play havoc with the accessories. Relays, for example, which perform satisfactorily in high-altitude chambers on the ground, might fail in the air

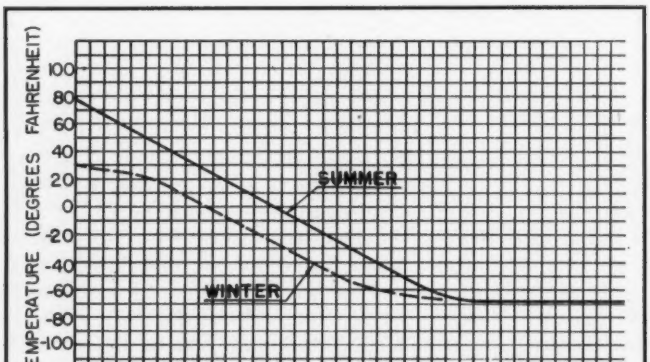


Fig. 1. Average summer and winter temperatures at various altitudes.

because the contacts are pulled apart in the first steep bank. Brackets which are calculated to withstand every conceivable, normal shock are torn out, and ducts which are believed to be amply supported fly to pieces. For this reason, the gravitational forces must be very much taken into account and do not exactly serve to facilitate the design of the heating equipment.

High Altitude Factors

The low humidity at high altitudes is a further factor which complicates the construction of aircraft accessories, as does vibration-control and proper means for shock absorption. It is self-evident that the equipment must be absolutely safe and foolproof, and require a minimum of control and servicing. Any hazard connected with such devices as heaters must be avoided, and there cannot be any interference whatsoever with any of the other components of the airplane.

All of this must be achieved at a minimum of space, current consumption and, before all, weight. The aircraft engineer is so weight-conscious that he will often spend days calculating and designing to save a fraction of an ounce. However, these fractions add up to ounces and pounds and, considering the thousands of parts that go into a modern airplane, the final saving may amount to hundreds of pounds. Commercial airlines figure that each pound of added weight costs them about $90 per year in loss of revenue from paying passengers and mail. Several hundred pounds per ship such as for the soundproofing installation, and if spent for a fleet of 10 ships, amount to a very sizeable sum. On the military aircraft, a few pounds of avoidable weight may mean a round of ammunition or a bomb less to carry and, possibly, the difference between victory and defeat.

Such are the requirements of heat supply and the conditions under which it must be furnished. The question arises as to what method to use in order to create that much heat and yet meet all of these requirements.

Methods of Heat Supply

Off-hand, it would appear that the enormous heat quantities coming out of the engine exhaust offer the most logical solution for the heat supply. Actually, a number of heating systems are based on the utilization of the heat in the exhaust gases although none of them has proven entirely satisfactory.

The simplest method of transferring this heat, and still in use on many airplanes, consists of putting a shroud around the tail pipe and ducting air through it. The disadvantages of this method are the weight of the heat exchanger, the danger of the burning-up of the tail pipe, if insufficiently cooled, and the infiltration of carbon monoxide into the ventilating air through cracks, leaks or bullet holes in the tail pipe. Another method of heat transfer from the engine exhaust entails the insertion of boilers into the exhaust pipe. These boilers serve to either create steam from water fed into them or to heat such fluids as glycol. The steam or

hot glycol is then piped into radiators within the cabin. While these methods, too, have numerous disadvantages, the steam system is still in use on several transports.

Electric heating is not practicable for one kilowatt of electric energy furnishes only about 3400 B.t.u. per hour, and the storage batteries on an airplane are not suitable for current drains large enough to supply a reasonable amount of heat. Electric heating is used on airplanes for applications which require only little heat, such as the well-known electric flying suits, heating pads for certain accessories, heating of the pitot static tube of the airspeed indicator, cooking purposes, etc.

The most popular of all present heating systems, although by no means perfect, is the so-called internal combustion system. Heaters of this type were developed from the "south wind" automobile heater and are based on a similar principle. A fuel-air mixture is burned within a small combustion chamber and heats air which is blown over the unit by means of a fan or scooped into the plane by the ram of the air in flight.

The presence of a carbon-monoxide generating unit within the airplane cabin is not comforting, nor is the existence of pipes carrying combustible mixtures. The need for a heat exchanger results in units which become large and heavy for greater heat outputs, and gasoline must be drawn from the fuel tanks to operate them. This makes it preferable to use small unit heaters in various parts of the plane rather than central heaters which are primarily suitable for large transports.

One of the main disadvantages of this heating system is its need for correct air supply for combustion. As can be seen from Fig. 2, the density of the atmosphere drops sharply with increase in altitude.

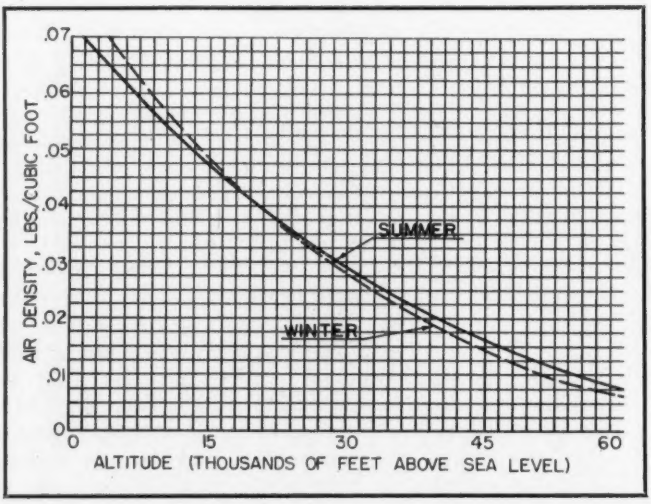


Fig. 2. Average summer and winter densities of the atmosphere at various altitudes.

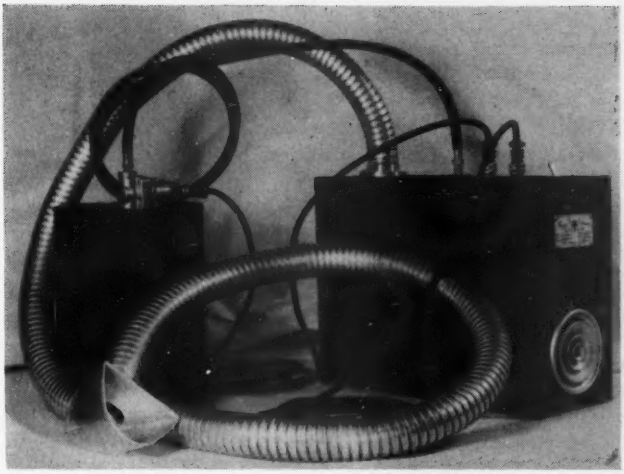


Fig. 3. High-altitude airplane heater, using propane as fuel.

At about 25,000 ft. altitude the atmosphere is only half as dense as it is at sea level, and at 35,000 ft. only a third. This means that, at 25,000 ft., twice as much air volume must be supplied as at sea level in order to obtain the same air weight.

As a result, internal combustion type heaters must be provided with some form of high-altitude compensation in their combustion air system. This, too, has proven to be quite a task and prevented such heaters from operating, let alone igniting at altitudes at which heat was needed most. In spite of all these difficulties and disadvantages this type of heater is used on most aircraft today because it is still more reliable, simpler and lighter than any other heating system developed to this date.

The Propane-Fired "Altiheater"

Recognizing the advantages of the internal combustion system for aircraft heating and trying to eliminate its many draw-backs, Pacific-Airmax looked for a more suitable fuel than aviation gasoline and finally decided to use propane. This choice of fuel brought about remarkable changes in the design of the entire system and the successful development of the propane-fired "Altiheater" which is shown in Fig. 3.

The principal advantage of using propane instead of gasoline lies in the fact that the exhaust products are non-toxic and can be discharged into the cabin. This eliminates not only spills and the problems connected with them—such as added drag, installation difficulties, piping of hot toxic gases, etc.—but, before all, the need for heat exchangers. This, in turn, results in much less weight, almost 100% efficiency of utilizing the heat content of the fuel, and low back pressures in the system. As a consequence, the blowers required to

overcome high back pressures in the combustion chamber, heat exchanger and exhaust, can be quite small or replaced by a simple scoop such as the one shown in Fig. 3.

Since the limits of inflammability of propane are considerably narrower than those of gasoline, the former is much less dangerous. Liquefied petroleum gases are not inflammable in their pure states. Gasoline has both of the hazards of a gas and a liquid in common usage.

A further advantage of propane is its greater heat content per pound which, in addition to its complete utilization, requires very much less fuel weight for a given hourly heat output. Another factor contributing to the decrease in weight is the lack of fuel pumps, with their motors and controls. The gas pressure of propane is high enough, even at low temperatures, to provide the necessary fuel quantities for combustion, requiring merely a pressure regulator to control the fuel flow. This, incidentally, makes propane preferable to butane which has a more unfavorable boiling point.

Thus, the use of propane as fuel permits the design of an airplane heater which is not only simpler, lighter and safer than a gasoline heater, but operates at very much lower cost. Last, but by no means least, the propane heater has made it possible to incorporate a system for high altitude operation which is extremely efficient. This system consists merely of coupling a fuel pressure regulator of conventional design with a somewhat larger regulator for the combustion air. Any decrease in air pressure with decreasing air density at higher altitude results in increased air flow until the air weight balances the corresponding fuel flow. Inasmuch as the two regulators compensate for any pressure changes automatically, the heater will function properly as long as enough air is provided through the scoop.

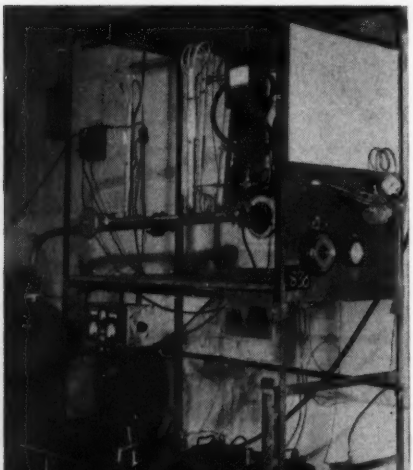


Fig. 4. Ground test equipment for propane-fired Altiheaters.

Altitude Heater Records Broken

The first tests with this system were conducted on the ground and with the equipment shown in Fig. 4. After proper adjustments had been made, the heater, now termed "Altiheater," underwent several flight tests during which all existing altitude records for heaters of this type were broken. At all altitudes reached during these flights, the Altiheater not only performed

perfectly but could be started without any difficulty whatsoever.

The particular unit shown in Fig. 3 is, essentially, a unit heater. Both ventilating and combustion air are taken in through the scoop. Fuel is supplied from light-weight tanks of varying size. Fuel and combustion air then flow through the high-altitude control, mix and are discharged into a combustion chamber where they are ignited and combusted. The ventilating air circulates around the combustion chamber to keep it cool and then combines with the exhaust products. This mixture, finally, is diffused into the cabin through an Anemostat. The entire control consists of nothing but an "on-off" toggle switch.

Unit Weighs Only 15 lb.

The unit has a rated heat output of 25,000 B.t.u. per hour and weighs only 15 lb. complete with all controls. These controls consist, in addition to the manual switch, of several safety controls which automatically turn the entire heater off, if there is insufficient air and fuel or a failure in operation. The tank as illustrated contains enough fuel to keep the heater burning at full output for about 3½ hours. It weighs a little more than 2 lb. empty and is provided with a General Controls solenoid shut-off valve which closes immediately, if the heater is turned off or anything goes wrong with it. This tank, with valve and regulator, is shown again in Fig. 5, in comparison with a standard fuel tank and regulator. As a further illustration, the Altiheater is shown standing beside a

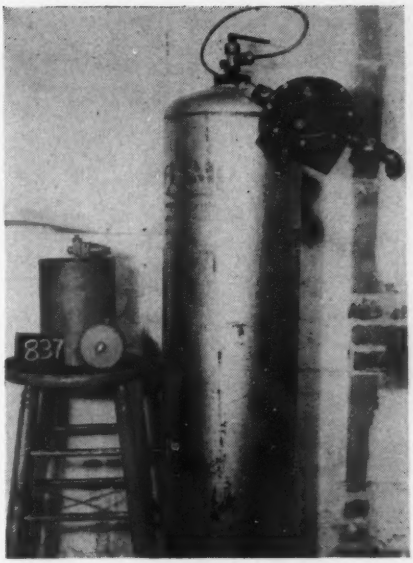


Fig. 5. Comparison of propane tank and regulator for Altiheaters (left) and conventional LP-Gas installations.

conventional ground heater of approximately the same heat output. (Fig. 6). Tanks with larger fuel capacity and heaters with greater heat output are neither much larger nor heavier and can be built to meet any requirements.

Uses for Propane-Fired Altiheaters

The Altiheater described above has been so successful in all tests that the use of propane as fuel appeared to be highly promising, and it is anticipated that the simplicity, safety and cheapness of the propane-fired heater will make it quite popular for heating private airplanes after the war. However, there is one single problem connected with propane which will prevent its general acceptance for the

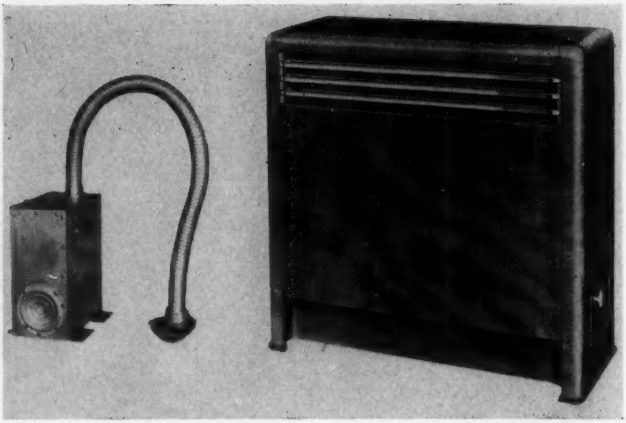


Fig. 6. Comparison of propane-fired airplane Altiheater (left) and Pacific-Airmax gas-fired ground heater, both rated at about 25,000 Btu.-per-hour heat output.

heating of military aircraft. This problem is not one of design or operation but of supply. While propane is available at most regular aircraft service depots and could be readily supplied to all airfields in times of peace, it cannot be distributed to the thousands of emergency fields all over the world on which military planes are serviced.

The problem of supply is actually so serious that it has compelled the Pacific-Airmax engineers to utilize the experiences gained with the propane heater and experiment with a gasoline model which is based on very similar principles. This has finally led to the development of a high altitude, high-output Altiheater which has a rated heat output of 250,000 B.t.u. per hour at a weight of only 23 lb. Since this younger brother of the propane heater is expected to play an important part in the heating of military aircraft during this war, the propane heater, although dormant for the duration, is contributing its share to the war effort.

War Production Board Makes New Appointments

Appointments of David G. Hawthorn as section chief of the Production Division and John H. Thacher, Jr., as technical consultant in the Natural Gas and Natural Gasoline Division, were announced recently by Deputy Petroleum Administrator Ralph K. Davies.

Mr. Hawthorn is chief of the newly formed Section of Materials and Equipment, which will handle the equipment requirements and allocation for the production branch of the oil industry as affected by the control materials plan.

A resident of Tulsa, Okla., Mr. Hawthorn is on leave of absence from the production department of the Amerada Petroleum Corp. Before joining the PAW, Mr. Thacher was attached to the executive office of the chairman of WPB.

As technical consultant to the chief of the Natural Gas and Natural Gasoline Division, Mr. Thacher will chiefly be responsible for technical work incident to providing and maintaining supplies of natural gas for industrial and other essential purposes.

Baking and Cooking Troubles Vanish When Butane Replaces Electricity

By F. N. MABEE

Manager, Colorado Natural Gas and Fuel Co., Denver Colorado

WHEN the Colorado State Penitentiary was recently remodeled butane gas, chosen to be the most satisfactory and dependable for cooking and baking, was installed by the Colorado Natural Gas and Fuel Co., of Denver. This installation was made possible through the cooperation of Warden Roy Best, Chief Clerk D. L. Hayes and Superintendent of Industries Kinney.

In remodeling the institute, Warden Roy Best worked on the theory that if the inmates actually knew and were associated with the better things of life, it would have the tendency to make them want to lead a better life on the outside.

It was with this thought in mind that Mr. Best remodeled the old mess hall into a very spacious kitchen, bakery and officers' mess. A new mess hall for the inmates was built, large enough to seat and feed the entire population, at this time approximately 1500 inmates. All this work has been done entirely with prison labor and in quality of workmanship would compare favorably with any contracted job.

The installation of a butane system was in line with such remodeling, and after considerable research and investigation, Warden Best was convinced of the economy, cleanliness and adaptability of butane as a fuel for baking and cooking.

The butane installation consists of two 1000-gal. tanks located between the wall encircling the main prison buildings and the secondary enclosure which is fenced and used as a prison quarry. The gas is then piped in 2-in. pipe a distance of 100 ft. to where it makes its entrance into the bakery. All pipe was run underground and was enclosed in a 6-in. casing running between the electric shop at one end and the main steam tunnel on the other. The pipe was thus assured of many years' service, being protected from direct contact with the earth and also having a constant circulation of air to keep the temperature well above freezing.

Many Appliances Are Used

The butane system is then continued into the bakery, where it supplies two ovens with an input each of 190,000 Btu. per hr., and a doughnut machine with an input of 100,000 Btu. The 2-in line is continued on from the bake ovens through the wall separating the bakery and kitchen. Three batteries of ranges are located in the kitchen consisting respectively of four, seven and three Majestic ranges. These ranges are located

Home office of the Colorado Natural Gas and Fuel Co., Inc., Denver, Colo.

conveniently on three sides of the large kitchen, which is in itself 41 ft. x 30 ft. in size.

Immediately adjoining the kitchen is the small officers' mess and kitchen, the latter containing a battery of three Majestic ranges, two of the griddle type and one of the open burner top type. The officers' kitchen also contains a Blodgett oven with an input rating of 100,000Btu. per hr. The maximum input rating of all appliances connected is 1,500,000 Btu. per hr. These require approximately 15 gal. per hr. with all appliances wide open.

The system was originally designed for a bakery only, as heretofore the institute had used electric ovens. When meat loaves and potatoes were baked in the electric ovens difficulty often arose when the juices from the food dropped down onto the red hot electrodes, necessitating constant replacement of these parts. This difficulty has been entirely eliminated through the use of butane.

Immediately after the installation of the bake ovens, officials investigated further and found that they could utilize the gas system to great advantage in the kitchen and so the batteries of ranges and additional ovens for the officers' mess were added without any changes in the system. It was understood that if the present system would not carry the load it would be a simple matter to use a vaporizer or install additional tanks. At this writing the original system has worked very satisfactorily due to the fact that the bakery is used from the hours of midnight until 4 a.m. and the kitchen ranges come into play immediately after the baking is finished.

Since the butane installation has been made it has averaged 50 gal. of gas per day, or approximately 1650 cu. ft. per day. This quantity of gas is handled through two "Rego" regulators, which have done a very remarkable job. We have made many tests on the line and have found that the greatest drop

in pressure, with all appliances full on, was less than one ounce. We have experienced no regulator trouble due to the overload and have maintained ample tank pressure during the peak load.

The system was installed under the supervision of our company engineers, and since its installation we have received many inquiries on the adaptability of such a system for the many army camps in and near Denver, and for its use as a standby plant for the defense projects in that area.

Since the freezing order, we have devoted our entire time to the building up of a gas load and have looked around for new ways to supply gas and keep our trucks in operation. At this time we are supplying gas to two rigs which are drilling in the state, one using approximately 1700 gal. every 24 hours and the other 1200 gal.

The Colorado Natural Gas and Fuel Co. has approximately 40 dealers handling propane gas and we are using about 1500 gal. daily for our bottled gas customers.

◆ ◆

Refining Industry Included In Essential Occupations

Paul V. McNutt, chairman of the War Manpower Commission, and Petroleum Administrator for War Harold L. Ickes issued the following joint statement Feb. 9:

"Reports are being received in Washington from a few places to the effect that oil company employees misunderstood the War Manpower Commission's recent statement about non-deferrable occupations.

"The reports are that oil, natural gas and gasoline company employees engaged in vital and essential jobs in that industry failed to report for work and instead were seeking employment in munitions plants or some other kind of work which they thought was listed as more essential by the War Manpower Commission.

"Petroleum is regarded as one of the most essential of war industries and has been so designated previously by the War Manpower Commission. Bulletins issued list 179 specific classes of jobs in the petroleum and natural gas industry and its transportation service which are directly classed as essential activities.

"Oil and natural gas are vital to this war and it does not help to win the war for men who have long been trained and skilled in this industry to leave their present jobs. We wish to emphasize that while planes, tanks, and ships fight the battles, they cannot fight without oil to fuel them. The production, refining, transporation and distribution of oil and gas are all necessary.

◆ ◆

Standards For Safety Valves Are Being Worked Out

Because a limitation order setting standards for safety valves is now being worked out, all reference to such valves has been deleted from Limitation Order No. L-134, which curtails the use of various metals in the broader category of controlled valves and regulators.

The administration of L-134 was recently transferred from the General Industrial Equipment Division to the Radio Division. The manufacture of safety valves will be supervised by the Shipbuilding Division.

Although manufacturers of safety valves are relieved of obligations created by L-134, WPB officials pointed out that their contracts generally were placed when the order was in effect and that they, therefore, conform to the standards set under it.

Propane Trailer Kitchens Are Ready for Emergencies

LIKE many other companies in the liquefied petroleum and natural gas fields, the Ohio Fuel Gas Co., Columbus, Ohio, has made extensive preparations for emergencies that might arise in this country as a result of bombing raids or other interruption of utility services.

Of special interest are two propane-equipped mobile kitchen canteens that have been outfitted by this company and are being demonstrated by employees and members of the Red Cross. The success of their operations is described by James E. Humphreys, director of advertising for Ohio Fuel Gas Co.:

"We attempted to build the maximum of cooking capacity into each unit. Plans were checked with large restaurant operators for the benefit of their suggestions.

"A manual was prepared to instruct Red Cross workers in the specific operations of these kitchens.

"Local Red Cross canteen units regularly operate from a stationary kitchen usually located in a lodge, church or school. Here they have the facilities for mass feedings that are not in regular full-time use. The mobile kitchens would be called in to supplement the capacity of local kitchens, or in case those to be fed were too far from the stationary kitchen to make transportation of hot food practical. Also, these kitchens can operate entirely independent of regular gas, electric and

The equipment for Ohio Fuel Gas Co.'s propane-equipped mobile canteens packed into the trailer and tow car and ready to roll.

The mobile kitchen set up and ready to be operated by Red Cross canteen workers.

water supplies, and it is possible that the disaster which would create the need for such feeding might put regular utility services out of commission. How much help would these units be? Their full capacity will not be known until the need arises, but restaurant people estimate that each unit is capable of handling hot food for 1500 people and possibly could serve continuously.

"Awaiting the call for emergencies, the mobile canteens cover our territory training Red Cross workers in their operation and assisting in securing additional volunteers for training. Trial feedings are held at war plants, schools, hospitals and with other organizations to give the women experience in operating the kitchens.

"The cooking and part of the food preparation are handled in the trailers. Serving, dishwashing and part of the food preparation are cared for in a 14x35-ft. tent which is erected over the trailer. Sidewalls on the tents and the water heating range connected to the outside of the trailer permit volunteers to work in comparative comfort even in below-freezing weather. All outside equipment packs in the trailers for transportation.

Propane Is Used for Fuel

"The fuel used is 'Protayne', a commercial bottled gas. Two 100-lb. tanks carried in each unit will furnish enough fuel for over 30 hours of continuous operation of the cooking, coffee and water heating ranges and the refrigerator. No place in our territory is more than an hour's ride from a replenishing supply of this gas. The electric system is either by storage battery or city current. If city current is not available, inside lighting is by stor-

age battery and the tent area is lighted by gasoline lanterns. A 100-ft. extension cord is carried to reach city current if available, which also permits the use of exhaust and circulating fans and the radio. A large water tank is built into the top and front of the trailer, permitting running water both at inside and outside faucets. A 50-ft. hose is carried for connecting to city water if such is available, in which case the tank is cut out. A 4-gal. water cooler and paper drinking cups provide drinking water for the workers. Such a unit could not attempt to furnish drinking water to the people to be fed in an emergency.

"The cooking vessels range from small pans to 20-gal. stock pots. The main range area can be covered with griddles for this type of cooking. Coffee is made in two heavily tinned 10-gal. urns which can be carried outside for serving. Skillets, kettles, mixing bowls, slicers, cutlery, scales, measures, etc., make up the other cooking utensils. The main cooking range uses bar burners to give the best heat distribution under large cooking vessels. It has a solid cooking area of 22 in. x 7 ft., plus four star burners at the end for small batch cooking. The coffee range is two star burners and the water heating range is the same type with four burners. In case of the need for stepping up cooking capacity, dishwashing could be dispensed with through the use of

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Interior of trailer kitchen looking to the rear. Main range is of special design by Peerless. Coffee range is standard heavy duty hot plate. Servel L-P Gas refrigerator is on the left.

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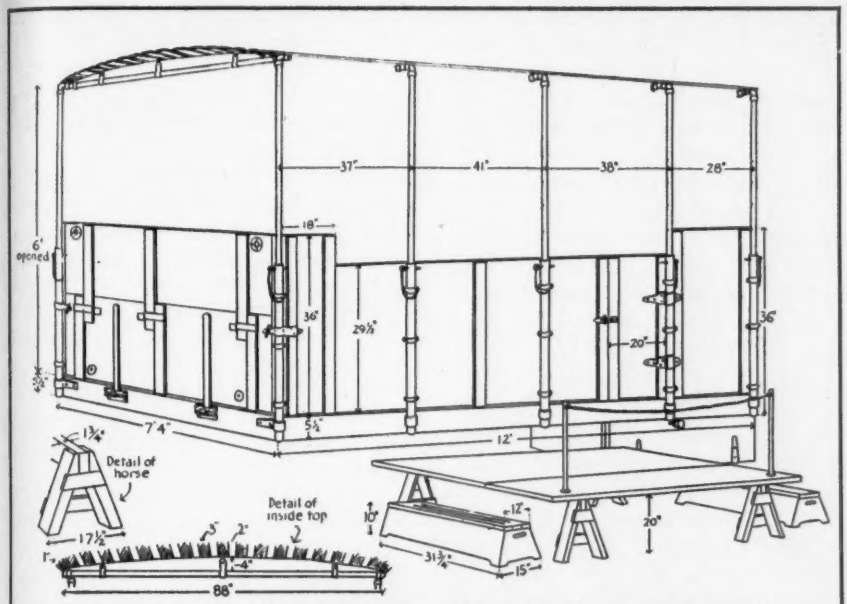


Details of truck body converted into mobile kitchen by Cornell University home economics department.

paper dishes and the use of water heating range could be applied to additional cooking. A 5-ft. Servel gas refrigerator provides storage for butter and cream. Bulk perishables are delivered to the point of feeding as needed in emergency feedings.

"The tow car has several uses besides pulling the trailer. It is a two-door sedan with only a single seat in front for the driver, permitting the car to become an office for the local chairman. A folding desk and Red Cross bulletin heads are provided to facilitate her work. Built into the car is a loud speaker system operating on either battery or city current. This can be used in directing the people to be fed, in explaining the unit to large groups or for music in case of parades. This equipment was salvaged from former cooking school operations.

"Also, the tow car is equipped with a folding cot and bedding to serve as a watchman's bed or an improvised ambulance should one of the volunteer workers be injured. Fire extinguishers and first aid kits are located both in the car and trailer. The manager of each unit is trained in advanced Red Cross first aid.

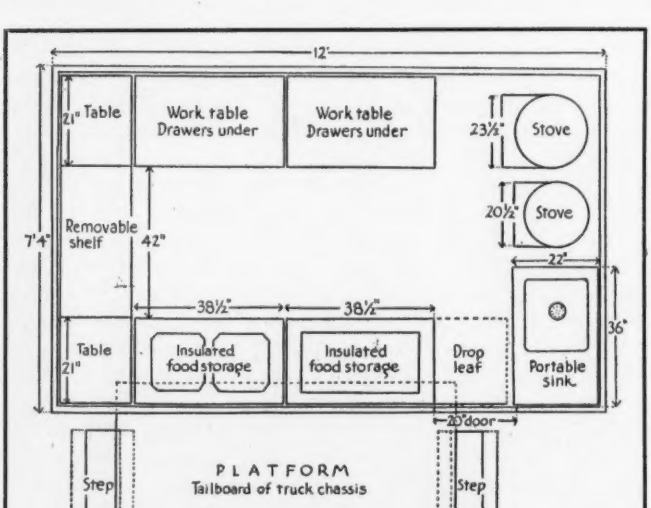
"The trailer and car are painted white with the lettering 'American Red Cross Emergency Canteen Kitchen, Unit No. 1 (or 2), sponsored by The Ohio Fuel Gas Co.' The Red Cross and the emergency

feeding insignia of civilian defense appear on the equipment. The manager of each unit has had several years experience as a gas service man as well as serving as manager of food institutes. Thus he is familiar with the problem as well as the territory and the company organization in the different cities. With two servicemen helping, the unit can be set up for operation in a little more than 30 minutes. Sand bags are used to hold the tent when staking is not permissible."

A mobile kitchen, using propane for fuel, was developed last summer by the home economics department of Cornell University, Ithaca, N. Y., which is also prepared to perform emergency service to marooned school children, war victims or war industrial workers who have insufficient cafe facilities.

The truck selected for the kitchen was a standard 1½-ton reconditioned one, with a bed approximately 7 x 12 ft. Vertical iron pipes that may be extended telescope-fashion form the framework to support the canvas top. The canvas top may be rolled up on one side or at one end during serving periods or it may be extended over the service line for protection against the weather. The floor of the truck is insulated with several layers of waterproof paper and a ½-in. layer of impregnated wallboard, topped with another kind of wallboard to protect workers against cold.

Two baker's stoves are equipped for burning propane gas for cooking, and the kitchen facilities make possible the serving of complete meals to from 100 to 150 persons, or a one-dish meal to 400 to 500.



Floor plan of Cornell mobile kitchen.

THE BOTTLED GAS MANUAL

Chapter 17

Competitive Fuels

—Wood—

In Two Parts — Part 2

• **Part 1 of Chapter 17 of the Bottled Gas Manual appeared in the February issue of Butane-Propane News, Page 38. Questions and answers for both parts are given this month. The author is C. C. Turner.—Editor.**

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Efficiencies of Application. We must now invade the sanctity of the American home and inquire intimately into the habits of the "wood burners." The "wood burner" is to be found in rural communities and upon farms. In the communities he represents an average family of four in a six-room house. On the farm his family averages five people in an eight room house. He uses wood in the kitchen stove, one parlor heater or a one pipe furnace. He needs heat in his home eight months of the year if he lives in the northern part of the United States. If he lives in the village he burns an average of one cord of wood per month for eight months and one-half cord of wood per month for four months—a total of 10 cords per year. If he lives upon the farm he averages burning 1½ cords of wood per month for eight months and three-fourths cord of wood per month for four months—a total of 15 cords per year.

Let us for the moment forget about the matter of space heating and see what the "wood burner" gets for his money in the four months he does not need heat.

1. He gets his meals cooked.
2. He gets either "top-of-the-stove" methods of water heating or an intermittent supply of hot water from a range boiler connected to the range.
3. He gets the litter and dirt, plus the labor which goes along with wood as a fuel.
4. He gets an over-heated kitchen and a wife made less attractive in both temperament and appearance.

We know from actual experience that with a modern propane gas range the town dweller could cook the meals for his family on 40 lbs. of propane per month, and the farm dweller on 45 lbs. He could install a modern automatic propane water heater and have its many advantages for only 40 lbs. of propane gas if he lived in town and 50 lbs. of propane if he lived on a farm. Being a "wood burner" and having the habit of keeping the wood fire burning from before breakfast until after supper he would use the same amount of wood whether he was depending upon the wood fire for hot water or not. We can therefore determine the efficiency of application by a comparison of the two fuels, taking 60% as the efficiency of the gas range and 70% as the efficiency of the water heater.

Let us first take the town dweller and consider his cooking problem only. If 40 lbs of propane will do the job, then the gross input is

$40 \times 21{,}633 = 865{,}320$ B.t.u.

As the appliance is 60% efficient the number of B.t.u. which actually go into the cooking of the food is

$.60 \times 865{,}320 = 519{,}192$ B.t.u.

If one-half cord of wood is used for this same purpose the gross input would be

$\frac{1}{2} \times 18{,}658{,}529 = 9{,}329{,}265$ B.t.u.

The over-all efficiency of wood as a cooking fuel would then be

$$\frac{519{,}192}{9{,}329{,}265} = .0557 \text{ or } 5.57\%.$$

Now let us add on the water heating load. If 40 lbs. of propane will do the water heating job the gross input is

$40 \times 21{,}633 = 865{,}320$ B.t.u.

As the appliance is 70% efficient the number of B.t.u. which actually go into heating water is

$.70 \times 865{,}320 = 605{,}724$ B.t.u.

The combined effective B.t.u. for propane amounts to 519,192 for cooking plus 605,724 for water heating, making a total of 1,124,916 B.t.u. Granting that the "wood burner" does not use any more fuel for both purposes than he does for cooking alone, he is still putting in 9,329,265 B.t.u. to accomplish a 1,124,916 B.t.u. job, and the over-all efficiency for both cooking and water heating is

$$\frac{1{,}124{,}916}{9{,}329{,}265} = .1205 \text{ or } 12.05\%!$$

Let us now journey to the farm where the usage of cordwood averages three-fourths of a cord for the four months in question. We know that we can do the cooking job for five farm people on an average of 45 lbs. of propane per month, or with a gross input of

$45 \times 21{,}633 = 973{,}485$ B.t.u.

If our efficiency is 60% then the number of effective B.t.u. required is

$.60 \times 973{,}485 = 584{,}091$ B.t.u.

The three-fourths of a cord of applewood required to do the same job contains

$.75 \times 18{,}658{,}529 = 13{,}993{,}897$ B.t.u.

and the over-all efficiency of wood as a cooking fuel would be in this instance

$$\frac{584{,}091}{13{,}993{,}897} = .0417 \text{ or } 4.17\%!$$

Let us add on the water heating load with no increase in the amount of wood burned. We can tackle this job with a well balanced installation on a consumption of 50 lbs. of propane per month, or with a gross input of

$50 \times 21{,}633 = 1{,}081{,}650$ B.t.u.

Taking 70% as the efficiency of our water heater, the effective B.t.u. would be

$70 \times 1{,}081{,}650 = 757{,}155$ B.t.u.

The combined effective B.t.u. needed for both cooking and water heating would be

$584{,}091 + 757{,}155 = 1{,}341{,}246$ B.t.u.

The over-all efficiency of wood would then be

$$\frac{1{,}341{,}246}{13{,}993{,}897} = .0958 \text{ or } 9.58\%!$$

We cannot establish definite rules for propane consumption on a per month, per person served, per service rendered, basis, for individuals differ in their demands, but we in this business can tell with a reasonable degree of certainly what the consumption may be. The two cases cited are typical ones, and we cannot therefore grant wood any more than 6% over-all efficiency when it is used solely as a domestic cooking fuel, or 12% over-all efficiency when water heating is combined with the cooking load. Bear in mind that we have based our figures on apple wood, and a cord of this most excellent of all wood fuels is almost as rare as hen's teeth!

Now let us turn our attention to the eight months in the year when the "wood burner" needs heat. Here we are faced with an entirely different problem, for if wood burning, space heating appliances have an efficiency of 50% we would have a tough job on our hands to deliver 50% of 18,658,529 or 9,329,265 B.t.u. for the same price as that of a cord of wood.* Well designed propane space heaters of the unvented type give efficiencies of approximately 90%. This means that we can get .90×21,633=19,469.7 effective B.t.u. out of each pound of fuel. If a wood burning space heater has an efficiency of 50% and a propane heater an efficiency of 90% the propane heater would be required to burn 9,329,265÷19,469.7=479.16 lbs. of propane to give the same amount of heat as the wood burning appliance would supply from a cord of apple wood. The ridiculously low prices at which propane would have to sell is brought out by Table 3.

Fortunately for us, the "wood burner" usually dwells in overheated rooms, and therefore does not give proper attention to insulation because he does not have to do it. We need but turn to the doctor to back up our argument that such living conditions are unhealthful. The "wood burner" does not need the high heat levels to which he is accustomed and they are positively detrimental to his well being. Here again we have an instance where although the appliance efficiency may be 50%, the over-all efficiency is in all probability far less due to wasteful methods of application. We can in many instances successfully compete with wood by:

1. Reducing temperatures to their proper levels.
2. Installing a propane heater that is balanced to the job.
3. Properly locating the propane space heater.
4. Using automatic temperature controls (thermostats).
5. Stopping heat losses through the use of insulation.

In brief, successful competition in the space heating field depends not upon an equal number of units of heat delivered for one cent or in the relative efficiencies of appliances but in making a less number of heat units do a better job.

Deciding Where and When Propane Can Compete Successfully. One can readily see that because

* The matter of space heating by propane is to be taken up in detail in Chapter 22.

of the great waste which occurs in the application of heat units available in wood, the way of determining whether or not propane can successfully compete with it is not on a comparative B.t.u. or efficiency basis. The proper way is first to estimate what the cost of doing the job with propane would be, then compare it with the known cost of doing the job with wood. If the space heating factor enters in to such an extent that we cannot handle the entire job at anywhere near a comparative cost we should recommend the installation of a bungalow or utility type of range, an insulated range boiler, and an automatic side arm or tank water heater to take care of the water heating problem in the summer months when the wood burning end of the range is inoperative. The proper method of making the installation so that the gas fired water heater will operate as an auxiliary unit in the summer time has been discussed in Chapter 15.

Table 4 shows comparative fuel costs which will assist you in quickly determining whether or not you can be competitive with any fuel. First carefully survey the job and determine what the consumption per month in pounds of propane will be if you tackle the job. Next, determine what the cost of doing the same job with the competitive fuel has been. At the point where the horizontal "Cost of Present Fuel" line intersects the vertical column of figures beneath the "Estimated Number of Pounds of Propane Consumption per Month" heading will be found the number of cents per pound which you can charge for propane and be on an equal cost basis. You will find that people will pay slightly more for the convenience of gas service, but if there is any great disparity between the price you charge for it and what the same job can be done for with another fuel you had better start trying to figure out how you can cut corners or compromise by way of making the application a two-fuel one; otherwise, you had better back out of the picture entirely.

TABLE 3. COMPARATIVE PRICES OF PROPANE AND WOOD TO DELIVER EQUAL AMOUNTS OF HEAT

(Based on apple wood, with a net heat content of 18,658,529 B.t.u. per cord and propane with 21,633 B.t.u. to the pound. Efficiency of wood heater 50%. Efficiency of gas heater 90%.)

Price of Wood Per Cord	*Price of Propane Per Pound*	*Price of Wood Per Cord*	*Price of Propane Per Pound*
$15.00	3.13 cents	$8.00	1.66 cents
14.00	2.92	7.00	1.46
13.00	2.71	6.00	1.25
12.00	2.50	5.00	1.04
11.00	2.29	4.00	0.83
10.00	2.08	3.00	0.62
9.00	1.87	2.00	0.41
		1.00	0.208

TABLE 4. COMPARATIVE FUEL COSTS

Estimated Number of Pounds Propane Consumption Per Month

Competitive Monthly Fuel Bill	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
	Price in Cents Per Pound at Which Propane Could Sell and Be Competitive for Above Monthly Poundages														
$1.50	5.00	4.28	3.75	3.33	3.00	2.72	2.50	2.30	2.14	2.00	1.87	1.76	1.66	1.57	1.50
1.75	5.83	5.00	4.37	3.88	3.50	3.18	2.91	2.69	2.53	2.33	2.18	2.05	1.91	1.84	1.75
2.00	6.66	5.71	5.00	4.44	4.00	3.63	3.33	3.08	2.85	2.66	2.50	2.35	2.22	2.10	2.00
2.25	7.50	6.42	5.62	5.00	4.50	4.09	3.75	3.46	3.21	3.00	2.81	2.64	2.50	2.36	2.25
2.50	8.33	7.14	6.25	5.55	5.00	4.54	4.16	3.84	3.57	3.33	3.12	2.94	2.77	2.63	2.50
2.75	9.16	7.85	6.87	6.11	5.50	5.00	4.58	4.23	3.92	3.66	3.43	3.23	3.05	2.89	2.75
3.00	10.00	8.57	7.50	6.66	6.00	5.45	5.00	4.61	4.28	4.00	3.75	3.52	3.33	3.15	3.00
3.25	10.83	9.42	8.12	7.22	6.50	5.90	5.41	5.00	4.64	4.33	4.06	3.82	3.61	3.42	3.25
3.50	11.66	10.00	8.75	7.77	7.00	6.36	5.73	5.38	5.00	4.66	4.37	4.11	3.88	3.68	3.50
3.75	12.50	10.71	9.37	8.33	7.50	6.81	6.25	5.76	5.35	5.00	4.68	4.41	4.16	3.94	3.75
4.00	13.33	11.42	10.00	8.88	8.00	7.27	6.66	6.15	5.71	5.33	5.00	4.70	4.44	4.21	4.00
4.25	14.16	12.13	10.62	9.44	8.50	7.72	7.08	6.53	6.07	5.66	5.31	5.00	4.72	4.47	4.25
4.50	15.00	12.84	11.25	10.00	9.00	8.18	7.50	6.92	6.42	6.00	5.62	5.29	5.00	4.73	4.50
4.75	....	13.57	11.87	10.50	9.50	8.63	7.91	7.30	6.78	6.33	5.93	5.58	5.27	5.00	4.75
5.00	....	14.28	12.50	11.10	10.00	9.09	8.33	7.69	7.14	6.66	6.25	5.88	5.55	5.26	5.00
5.25	....	15.00	13.12	11.60	10.50	9.54	8.75	8.07	7.50	7.00	6.56	6.17	5.83	5.52	5.25
5.50	....	....	13.75	12.20	11.00	10.00	9.16	8.46	7.85	7.33	6.87	6.47	6.12	5.78	5.50
5.75	....	....	14.37	12.70	11.50	10.40	9.58	8.84	8.21	7.66	7.18	6.76	6.38	6.05	5.75
6.00	....	....	15.00	13.33	12.00	10.90	10.00	9.23	8.57	8.00	7.50	7.05	6.66	6.31	6.00
6.25	....	....	....	13.80	12.50	11.36	10.41	9.61	8.92	8.33	7.81	7.35	6.94	6.57	6.25
6.50	....	....	....	14.40	13.00	11.81	10.83	10.00	9.28	8.66	8.12	7.64	7.22	6.84	6.50
6.75	....	....	....	15.00	13.50	12.27	11.25	10.38	9.64	9.00	8.43	7.94	7.50	7.10	6.75
7.00	....	....	....	....	14.00	12.72	11.66	10.76	10.00	9.33	8.75	8.23	7.77	7.36	7.00
7.25	....	....	....	....	14.50	13.18	12.08	11.15	10.35	9.66	9.06	8.52	8.05	7.63	7.25
7.50	....	....	....	....	15.00	13.63	12.50	11.53	10.71	10.00	9.37	8.82	8.33	7.89	7.50
7.75	....	....	....	....	....	14.09	12.91	11.92	11.07	10.33	9.68	9.11	8.38	8.15	7.75
8.00	....	....	....	....	....	14.54	13.33	12.30	11.42	10.66	10.00	9.41	8.88	8.42	8.00
8.25	....	....	....	....	....	15.00	13.75	12.69	11.78	11.00	10.31	9.70	9.16	8.68	8.25
8.50	....	....	....	....	....	....	14.16	13.07	12.14	11.33	10.62	10.00	9.44	8.94	8.50
8.75	....	....	....	....	....	....	14.58	13.46	12.50	11.66	10.93	10.29	9.72	9.21	8.75
9.00	....	....	....	....	....	....	15.00	13.84	12.87	12.00	11.25	10.58	9.99	9.47	9.00
9.25	....	....	....	....	....	....	....	14.23	13.21	12.33	11.56	10.88	10.27	9.73	9.25
9.50	....	....	....	....	....	....	....	14.61	13.57	12.66	11.87	11.17	10.55	10.00	9.50
9.75	....	....	....	....	....	....	....	15.00	13.92	13.00	12.18	11.47	10.83	10.26	9.75
10.00	....	....	....	....	....	....	....	....	14.28	13.33	12.50	11.76	11.11	10.52	10.00
10.25	....	....	....	....	....	....	....	....	14.64	13.66	12.81	12.05	11.38	10.78	10.25
10.50	....	....	....	....	....	....	....	....	15.00	14.00	13.12	12.35	11.66	11.05	10.50
10.75	....	....	....	....	....	....	....	....	....	14.33	13.43	12.64	11.94	11.31	10.75
11.00	....	....	....	....	....	....	....	....	....	14.66	13.75	12.94	12.22	11.57	11.00
11.25	....	....	....	....	....	....	....	....	....	15.00	14.06	13.23	12.38	11.84	11.25
11.50	....	....	....	....	....	....	....	....	....	....	14.37	13.52	12.77	12.10	11.50
11.75	....	....	....	....	....	....	....	....	....	....	14.68	13.76	13.05	12.36	11.75
12.00	....	....	....	....	....	....	....	....	....	....	15.00	14.11	13.33	12.63	12.00
12.25	....	....	....	....	....	....	....	....	....	....	....	14.41	13.61	12.89	12.25
12.50	....	....	....	....	....	....	....	....	....	....	....	14.70	13.88	13.15	12.50
12.75	....	....	....	....	....	....	....	....	....	....	....	15.00	14.16	13.42	12.75
13.00	....	....	....	....	....	....	....	....	....	....	....	....	14.44	13.68	13.00
13.25	....	....	....	....	....	....	....	....	....	....	....	....	14.72	13.94	13.25
13.50	....	....	....	....	....	....	....	....	....	....	....	....	15.00	14.21	13.50
13.75	....	....	....	....	....	....	....	....	....	....	....	....	....	14.47	13.75
14.00	....	....	....	....	....	....	....	....	....	....	....	....	....	14.73	14.00
14.25	....	....	....	....	....	....	....	....	....	....	....	....	....	15.00	14.25
14.50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14.50
14.75	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14.75
15.00	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15.00

The Merits of Wood as a Fuel. The principle advantages of wood as a fuel are as follows:

1. The large quantity of heat units which can be bought for a cent.

2. Being primitive man's first fuel, its use comes more or less instinctively to us.

3. It can be burned in low-cost appliances.

4. Its ash has a value for garden fertilizing, also as an insecticide on certain plants, and can be used for making lye for home soap making.

5. In many instances its cost to the farmer is merely his time cutting it, plus his cost of hauling it, plus the taxes which he has paid upon it as woodland.

6. It can be stored in almost any place where it can be kept dry.

Boiling these down, all of them excepting the second have a financial reason at the bottom of them, and this should not be too hard to combat with any other fuel that can give better net results at anywhere near the same cost. Few people in figuring the cost of wood as a fuel include *all* of the costs, and we must impress upon them that the *delivered cost* is not the entire cost of a fuel. We shall find many additional costs in our listing of the disadvantages of wood as a fuel in the following paragraph:

The Disadvantages of Wood as a Fuel.

1. The inefficient application of the number of heat units bought for a cent.

2. Although almost anyone can light a wood fire it requires considerable skill to operate one efficiently.

3. It is not a uniform fuel.

4. Uniform cooking results are almost impossible because of the difficulty in controlling the fire to accurate temperatures.

5. Appliances deteriorate rapidly because of the intense heat and the corrosive action of creosote and other distillates in the combustion gases.

6. Ash is corrosive when wet.

7. Large chimneys and drafts required.

8. Stove pipes, linings and grates have to be more frequently replaced than with any other fuel.

9. Combustion gases particularly destructive to mortar; therefore, "pointing up" of the chimney is more frequently required.

10. The manual labor required in its preparation and handling could be better and more profitably applied elsewhere.

11. The growth cut would return a greater revenue if allowed to grow and sold for other uses.

12. It requires constant attention, thereby making it impossible to leave home in cold weather for any length of time unless water pipes are drained and food stuffs stored where they will not freeze.

13. It requires more storage space than any other fuel.

14. It is difficult for women to handle.

15. It creates the problem of ash disposal.

16. It creates a lot of dirt, mess, and dust.

17. Appliance flues require frequent cleaning.

18. It is responsible for excessive variations in temperature which have their effect upon the bodies and minds of those subjected to them.

19. It is responsible for more fires in rural districts than any other fuel. These fires may be classified as follows:

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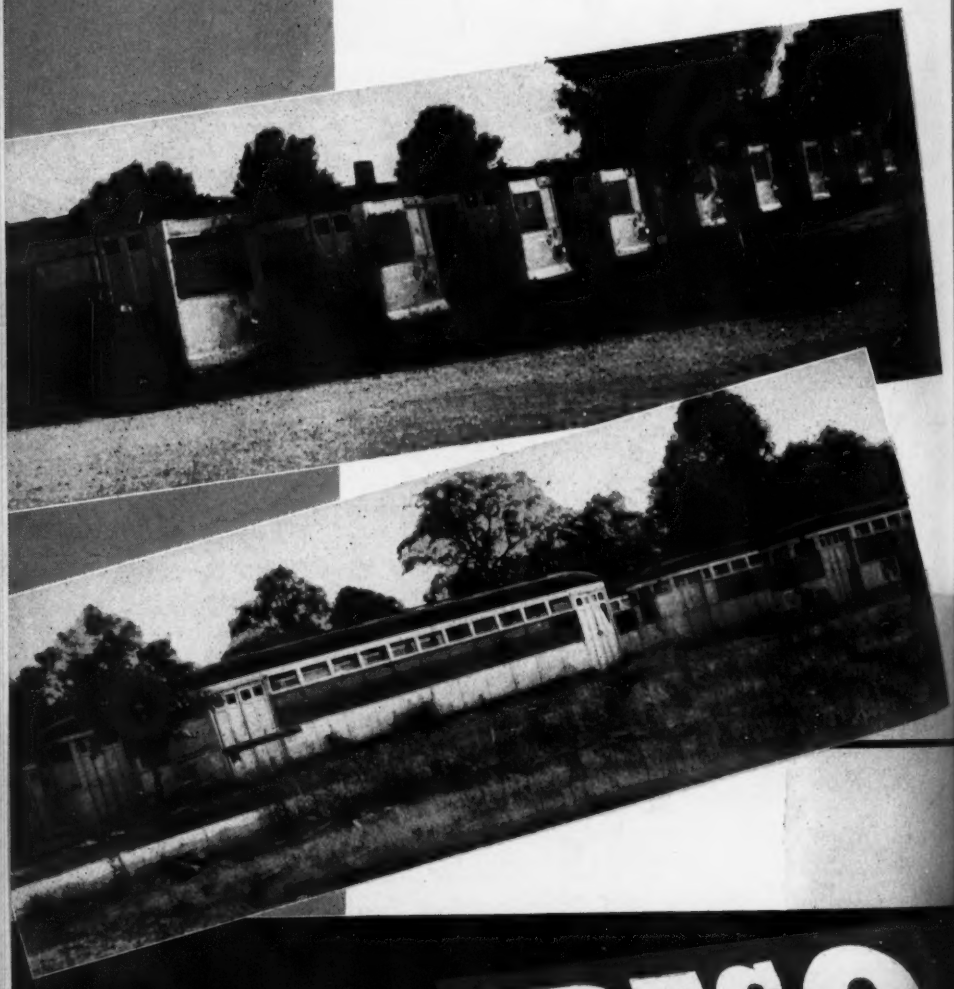

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TO meet the shortage of housing facilities at a newly-constructed southern ordnance plant, obsolete street cars were drafted and converted into comfortable apartments of various sizes for the employees and their families. These unique street car homes are grouped around central dining and administration cars, weatherstripped, and include cars built dormitory-fashion for men without families.

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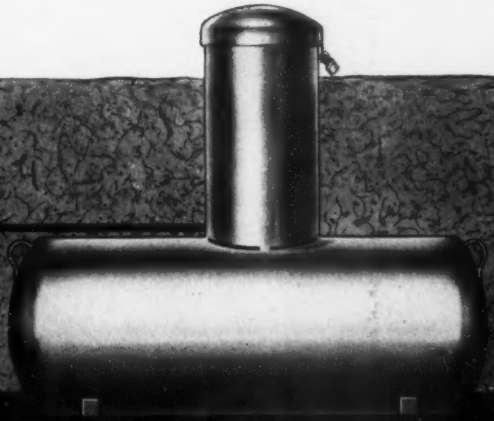

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REGO LP GAS EQUIPMENT

UL

A. Chimney fires, caused by creosote and carbon on inside of chimney catching fire.

B. Overheated woodwork adjacent to a hot stove or flue.

C. Sparks or coals dropped upon wooden floors or rugs.

D. Explosions.

Explosion with wood? Certainly. Close a wood burning stove up tightly with a supply of wood on top of burning coals. Gases will be distilled off from the wood and accumulate within the stove, stove pipe and chimney. When the igniting temperature of these gases is reached they ignite and burn with explosive force. I have actually seen the top of a stove blown off, the stove pipe ripped apart and a brick chimney cracked by the force of one of these explosions. Many a camp or other building has been burned flat to the ground as the result of such an explosion occuring in so-called "air tight" or sheet metal stoves.

Getting the Customer to Figure the Actual Cost of Wood Burning. I have previously said that the delivered cost of wood is not the entire cost of the fuel. Here is a set of questions to ask the "wood burner." If he answers them correctly it will open his eyes.

1. How many cords of wood do you burn per year? .....
2. How much does it cost you delivered, per cord?.....$.....
3. If you own your wood lot, what taxes do you pay on it per year? $..... (Here you should divide the amount paid in taxes by the number of cords burned and carry the result out.) .....$.....
4. How often do you have to buy new linings and grates for your wood burning stove?.....
5. How much does this renewal cost?..... (Here you should divide this amount by the number of years given in four, then divide the result by the number of cords burned per year and carry this amount out.) .....$.....
6. How often do you have to renew your stove pipe? .....
7. What does each renewal cost? $..... (Here you should divide this amount by the number of years given in six, then divide the result by the number of cords burned each year and carry the result out.)$.....
8. How often do you have to point up your chimney? .....
9. What does this re-pointing cost? $..... (Here you should divide this amount by the number of years given in eight, then divide the result by the number of cords burned each year and carry the result out.) .....$.....
10. What part of your taxes do you believe should be charged against that part of your buildings that you use for wood storage? $..... (Divide this amount by the number of cords burned each year and carry the result out.)$.....
11. How much time do you

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Many war plants today are equipped with Algas "Gas-air" Units—instantly ready in any emergency to supply fuel from storage tanks right on the factory premises!

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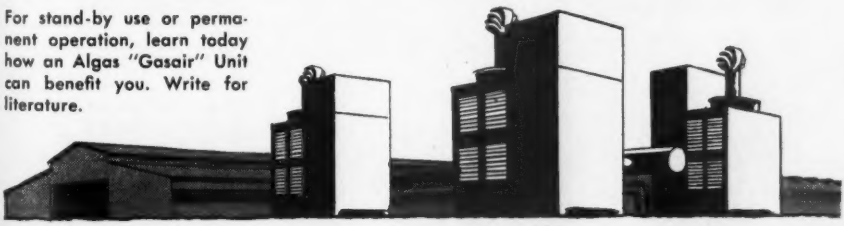

spend each year in the preparation and handling of wood?.....

12. What could you sell this time for if you devoted it to something that would bring you in some money? $..... (Divide this amount by the number of cords burned each year and carry the result out.) $.....
13. What do you have to pay per cord for sawing and splitting? .....$.....

Total actual cost of a cord of wood .....$.....

You haven't included in the above the cost of dust, mess and wear and tear upon the furniture and the house. You haven't placed any value on the good times missed, the trips that could have been taken if only the old wood stove hadn't required attention, and many other of the precious intangibles lost that otherwise would have helped to make life the more worth while!

This has been a long session tonight, and the wood coals upon Gracourt's hearth glare as if to reproach us for the unkind things we have said about them. We have not meant to be unfair or unkind, for wood fires have their place, but it is not in a fast moving world or in our crazy hunt for modern comforts and conveniences. When we can have the care-free luxury of propane gas service at no more cost, why not have it?

Now, for the questions on Chapter 17. Then check with the correct answers on Page 68.

Questions on Chapter 17

1. On what basis is the heat content of all woods approximately the same?
2. How many cords of white pine wood are equivalent to five cords of white oak wood in heat content?
3. What four other fuels are competitive to gas in the United States?
4. What are the five principal constituents of wood?
5. How many cubic feet of solid matter make up the average cord of wood?
6. Under what conditions would the gross heating value and the net heating value of a fuel be the same?
7. What five things can we do to place propane gas on a competitive footing with wood as a fuel?
8. You have estimated that a certain job will use 85 lbs. of propane per month. The cost of a competitive fuel to do the same job is $10. At what price could you sell propane and be competitive? (Use the "Competitive Fuel Cost Table.")
9. In what four ways can wood cause destructive fires?
10. If it requires a cord of red maple wood to do the work of 100 lbs. of propane, and the propane is being utilized at an efficiency of 60%, what is the efficiency of the wood?

Dessert for the Axis

Folks working at our Robertshaw Thermostat plant are pretty busy these days cooking up a little dessert for the Axis—their "just desserts," if you know what we mean. Such indigestible little items, for instance, as hand-fuses for hand-grenades and primers, and ignition cartridges for rockets. Then there are boosters and shells and delicate but vital precision instruments for airplanes—just what our boys need to dish out the right kind of dessert for Tojo, Mussolini and the smaller fry at Hitler's table.

That's why our peacetime job of turning out Robertshaw Thermostats has been laid aside. What thermostats are coming off our production lines are limited in number—just those called for by your Uncle Sam to supply official needs. That helps our engineering and research departments to keep pace with new developments that will mean newer and better Robertshaw Thermostats when victory banquets are in order.

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NGAA Will Convene April 14-16 To Consider Vital War Aids

THE twenty-second annual convention of the Natural Gasoline Association of America is to be primarily concerned with the problems of stimulating production of products needed in the war effort, according to Ray E. Miller, Hanlon - Buchanan, Inc., Tulsa, president of the Association. The convention dates which have just been announced are April 14-16 in the Baker hotel, Dallas.

WM. F. LOWE

In speaking about the meeting, Mr. Miller stated the NGAA board of directors had given serious consideration to Government requests for trade groups to forego or curtail their usual conventions this year. "We appreciate the reasons which prompt this request," he said, "but we believe the type of discussions planned for this convention are in the national interest since they will aid the industry to correlate its efforts in the war program and thereby increase its effectiveness. The natural gasoline and distillate industries are large producers of the prime raw materials used in manufacturing high octane aviation fuels, rubber and chemicals and a meeting of the executives and technical men of these industries to discuss the problems involved will have a definite stimulus to their production."

While the dates announced cover a period of three days, the program is to be so arranged as to avoid as much train congestion as possible. Only committee meetings and reports are scheduled for Wednesday, the first day. Thursday is to be full with morning, afternoon and evening sessions and the convention will close Friday noon. Announcement to this effect was made by James W. Vaiden, vice president, Skelly Oil Co., Tulsa, chairman of the program committee. Other members of that committee include: John B. Atkins, The Parade Co., Shreveport, La.; Paul C. Coffin, Shamrock Oil & Gas Co., Amarillo, Texas; Howard Felt, Warren Petroleum Corp., Tulsa; Dr. O. L. Roberts, Atlantic Refining Co., Philadelphia; Harry Wheeldon, Lone Star Gasoline Co., Dallas, Texas; and C. R. Williams, The Chicago Corp., Corpus Christi, Texas.

William F. Lowe, NGAA secretary, urges that all who plan to attend these sessions make their room reservations direct with the Baker hotel as soon as possible, since confirmed hotel reservations are as important as train reservations these days.

◆ ◆

Thermogas Home Service Director Is Army Dietician

Miss Katherine Kratoska, for a number of years director of the home service department of Thermogas Co., Inc., Des Moines, Iowa, has been appointed dietician in an army base hospital in Hawaii, according to word received from Chas. Russell, president of the Thermogas company.

Eight other former employees of the company are now in the armed services.

A job you can do and do well is to promote the sale of U. S. War Bonds. Tell your customers and prospects to Buy Bonds—all they possibly can. When peace returns and our boys come marching home—then you can sell those sparkling new Roper C.P. Gas Ranges. In the meantime, housewives should be encouraged to take care of the gas ranges they have—to make them last for the duration.

Write today for free sample booklet—"Care and Operation of the Gas Range," an informative booklet for the housewife. Available for quantity distribution at 10c each.

CARE and OPERATION of the new ROPER GAS RANGE
TOP-OF-RANGE DIRECTIONS
BROILING DIRECTIONS
OVEN DIRECTIONS
CANNING DIRECTIONS

GEO. D. ROPER CORPORATION
General Sales Office and Plant: Rockford, Illinois

ROPER GAS RANGES FOR ALL GASES INCLUDING (LP) LIQUEFIED PETROLEUM GAS

ENSIGN

BUTANE-PROPANE CARBURETORS HAVE GONE TO WAR

BUT THEY'LL BE BACK BETTER THAN EVER

ENSIGN'S modern manufacturing facilities and more than 30 years of experience in producing efficient carburetion equipment are now all-out for Victory. Day and night, we are devoting practically our entire resources to help win the war.

But, although unable to provide our usual prompt service due to the war's demands, ENSIGN Butane-Propane Carburetion Equipment is still available, and quick delivery of emergency parts is being maintained.

Now, as in the past, ENSIGN Carburetors for Butane-Propane and Gasoline still lead the field for internal combustion engines of all types and sizes.

ENSIGN

CARBURETOR CO., LTD.

HUNTINGTON PARK • CALIFORNIA

Before ordering ENSIGN Butane-Propane Carburetion Equipment or Parts, read W.P.B. General Limitation Order L-86. Copies can be obtained from your nearest W.P.B. office.

BUTANE Power

Refrigerated Manifold Is Developed For Internal Combustion Engine

INCREASED performance from internal combustion engines using LP-Gases as fuel can be obtained by pre-cooling the mixture before it enters the cylinders, according to a recent bulletin issued by Green's Fuel, Inc., Sarasota, Fla., of which K. H. Koach is general manager. Tests were carried out with specially adapted manifolds furnished by Nelson M. Jones. The process is described as follows:

Using the latent heat of vaporization of the butane fuel to lower the intake manifold temperatures permits a more normal weight of charge to enter the cylinder. By applying refrigeration principles to manifold construction any degree of pre-cooling can be obtained. The usual procedure has been to waste this latent heat through a heat exchanger.

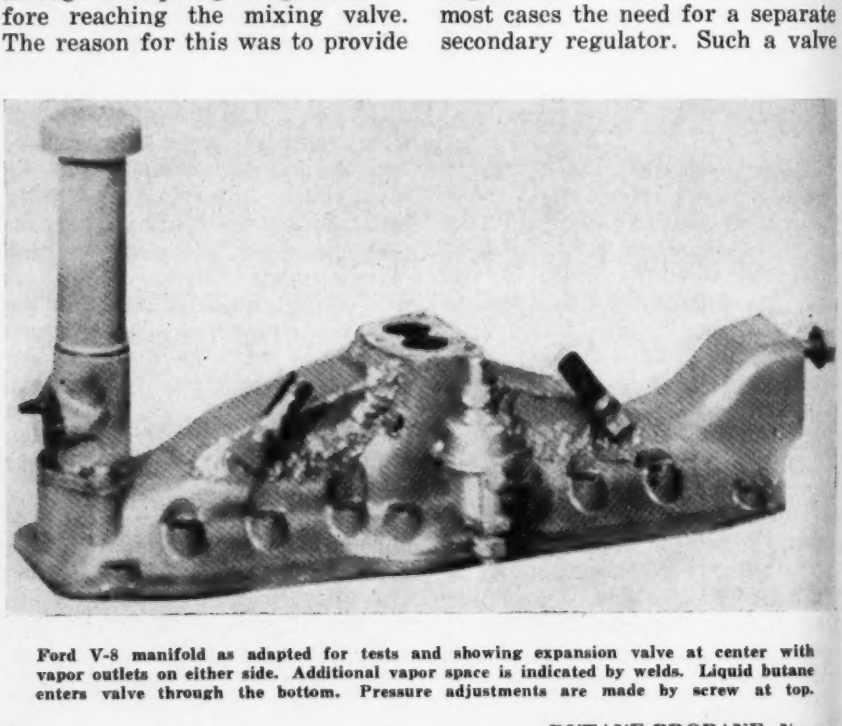
This refrigerated manifold is covered by a patent taken out by Green's Fuel after a series of tests involving this principle. The accompanying illustration shows a test manifold of a Ford V-8 engine used in experiments at the University of Florida engineering laboratory. Because of war restrictions a manifold casting of the desired design could not be obtained, so a standard Ford aluminum intake manifold was used. The exhaust heating space was blocked off and used as an expansion chamber, together with additional expansion spaces welded on as shown. The expansion valve seen at the center of the manifold is a standard refrigeration valve, type 672, made by the Detroit Lubricator Co., and is a highly developed and trouble-free device. It is connected so as to discharge butane vapor directly into the before-mentioned expansion space and acts also as a primary regulator. It is fed by a fuel line taking liquid butane from the storage tank at normal pressure and can be set to maintain any desired vapor pressure in the expansion space of the manifold. This pressure can range from atmospheric to 30 lb. as desired. The vapor is drawn from the chamber through the two connections shown and can be conducted directly through hose to the mixing valve if a suitably low setting of the expansion valve is used, thus eliminating the need of other regulators. After leaving the carburetor the

mixture of air and vapor enters the manifold passages in the usual manner, where its temperature is reduced by contacting the passage walls it has previously cooled.

An asbestos gasket is used between this manifold and the cylinder block. This effectively prevents any heat transmission from the hot block, the only metal-to-metal contact being that occasioned by the hold-down cap-screws. The slight amount of heat transmitted here is sufficient to insure complete vaporization of the injected fuel.

For the purposes of dynamometer-testing the motor, an expansion space pressure of 1 lb. per sq. in. was used and the vapor was passed through a diaphragm regulator before reaching the mixing valve. The reason for this was to provide as near constant and even a fuel mixture as possible to prevent slight variation in RPM under full throttle load during the tests. The mixing valve (or carburetor) used was a standard butane commercial type for the 1941 Model Ford 85 hp. motor used. The test runs made were the refrigerated manifold against a manifold without refrigeration. No attempt was made at economy tests versus gasoline as the engine compression was not raised to take advantage of butane performance. The conventional spark setting was likewise used without change.

It is understood that a more suitable expansion valve than the 672 type can be produced and better engineered so as to eliminate in most cases the need for a separate secondary regulator. Such a valve



Ford V-8 manifold as adapted for tests and showing expansion valve at center with vapor outlets on either side. Additional vapor space is indicated by welds. Liquid butane enters valve through the bottom. Pressure adjustments are made by screw at top.

cannot now be produced in small lots on account of war restrictions but would cost approximately $3.50 in reasonable quantities when available. A more suitable valve and a properly designed and cast manifold would increase the efficiency considerably, and the amount of cold could also be thermostatically controlled to suit different operating conditions. Pre-cooling is also more effective on updraft manifolds than those of the downdraft type as used in the test.

There was no tendency of the expansion valve to freeze or cease to function during the test runs although atmospheric moisture was condensed over the outside in the form of thick frost. This was permitted as a check procedure although standard refrigeration practice is to protect these valves with a rubber cover. It would also be possible to combine this valve with the carburetor casting for simplification. The use of such a manifold system not only increases the efficiency of the motor but does it with less parts and other complications which are a source of trouble on present types.

The following conclusions were drawn from test data:

1. Using Green's Fuel (butane) with the Jones refrigerated manifold,

The power increase at 1036 RPM is 2.2 HP or 8.5% gain.

The power increase at 2001 RPM is 6 HP or 12% gain.

The power increase at 2983 RPM is 6.2 HP or 8.6% gain.

The power increase at 3600 RPM is 2.3 HP or 3% gain.

2. The greatest power increase is thus shown to be through the normal driving range and the power increase through this range will average 9.7%.

3. Saving in fuel consumption can be expected in direct ratio to the above percentages.

◆ ◆

Guide Book For Range Owners Is Offered By Tappan Stove

To help Tappan owners get top performances from their gas ranges, the Tappan Stove Co., Mansfield, O., is offering a free 32-page booklet, the "Tappan Owner's Guide."

Although designed primarily to supply the housewife with helpful tips on the use of her range, the "Owner's Guide" is also expected to lessen the servicemen's burden by encouraging home range repairs and adjustments.

Subjects covered include: adjustments, replacements, care, cleaning, time and temperature charts for all cooking operations; tips on fuel saving; detailed instructions on the best methods of top-burner cooking, baking, roasting, broiling and canning; and solutions to common cooking problems.

◆ ◆

Increased Business Compels Larger Quarters for Anchor

An increased volume of business, consisting of materials supplied to refineries for the manufacture of aviation gasoline; to chemical organizations that are using propane for the manufacture of styrene, and to large industries for various uses, has compelled Anchor Petroleum Co., Tulsa, Okla., to acquire more office space and to increase its personnel substantially recently.

Five additional rooms have been leased in the Atlas building in Tulsa, which now gives the company one entire floor of the building.

Random Shots At The Parade

By W. W. BANKS

We can fight in this war without carrying a gun! We have all come to realize that making articles for war, buying War Bonds, and keeping up home morale is "passing the ammunition" to the man on the firing line.

•

You are helping to win the war when you show your customers how to get more service from their equipment by keeping appliances adjusted to conserve on fuel . . . by making suggestions that will increase the life and utility of their system.

•

You are helping yourself and helping the war effort when you prevent rust erosion on your transport tank by repainting often as needed . . . by taking care to prevent kinks in the hose and damage to its interior and by generally taking better care of equipment.

•

Like most businesses these days, we have gone to war by working extra shifts on government contracts but remind you that when priorities have become a memory we shall be in a position to continue where we left off with the best that experience and engineering can produce.

•

Urge your customers to buy today, the ECONOMY BUTANE SYSTEM they will want tomorrow, with War Bonds!

DALLAS TANK AND WELDING COMPANY, INC.
201-5 W. COMMERCE ST. DALLAS, TEXAS

Directors Name S. H. Hobson To Roper Corp. Presidency

At the annual stockholders' meeting and a subsequent directors' meeting held at the Geo. D. Roper Corp. offices, Rockford, Ill., Jan. 26, S. H. Hobson was elected a member of the board of directors and president to succeed Mabon P. Roper, who died recently.

Shelby L. Large and Hugo L. Olson, of Rockford, and Bert Pratt and J. Sanford Otis of Chicago were re-elected to the board of directors.

All officers of the company were reelected, including W. E. Derwent, E. Carl Sorby and J. P. Curtin, vice presidents, and Floyd K. Lawson, secretary-treasurer. Manufacturing operations will be under the supervision of Otto Olson, works manager.

Mr. Hobson, who is a well-known figure in industry, started with the Roper organization 28 years ago and moved progressively from assistant foreman up to the presidency.

As chief engineer from 1919 to 1929 he supervised the entire building expansion program involving the planning and construction of the present Roper plant, completed in 1929.

When the Roper-owned Blackhawk Engineering Co. was formed in 1941, Mr. Hobson was made president of that company while continuing to act as executive vice president of the Geo. D. Roper Corp.

◆ ◆

H. E. Thomas Elected Head Of Compressed Gas Men

H. Emerson Thomas, New York City, was elected president of the Compressed Gas Manufacturers Association Jan. 24-24.

Mr. Thomas has also served as president of the LP-Gas Association.

Left to right: J. P. Curtin, W. E. Derwent, E. Carl Sorby, S. H. Hobson (seated), Otto Olson and F. K. Lawson, newly elected officers of the Geo. D. Roper Corp.

Louisiana's Butadiene Supply To Be Polymerized Soon

According to a recent announcement from Cleveland, Ohio, synthetic rubber components produced at Baton Rouge and Lake Charles, La., by Cities Service Co. and Standard Oil Co. of Louisiana, will be polymerized in two nearby plants to be operated by Firestone Tire & Rubber Co.

The Cities Service refinery at Lake Charles promises to be one of the most modern plants in the nation for the production of synthetic rubber components in addition to other war and civilian materials.

H. K. Ferguson Co., Cleveland, was awarded the contract for construction of two polymerization plants by the Defense Plant Corp., subsidiary of the Reconstruction Finance Corp., which will own the installations.

One of the pioneer producers of butadiene, Standard Oil Co. of Louisiana is augmenting its standard facilities by increased capacity.

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Dr. E. W. Reid Is Appointed To Industry Divisions

Appointment of Dr. Ernest W. Reid, Pittsburgh, Pennsylvania, as Deputy Director General for Industry Divisions, succeeding Curtis E. Calder, was announced Jan. 20 by the War Production Board.

Dr. Reid, who has served WPB and its predecessors in many capacities, was formerly Mr. Calder's assistant.

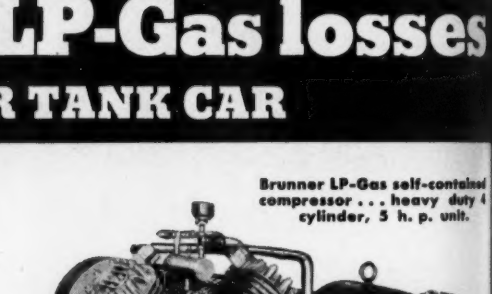
Prior to coming to Washington to help in the direction of the chemicals and of the war effort, Dr. Reid was a Senior Industrial Fellow for the Mellon Institute of Industrial Research, Pittsburgh, and also Director of European Affairs for the Union Carbide and Carbon Co.

How to cut LP-Gas losses
500 to 1000 lbs. PER TANK CAR

BRUNNER

LP-Gas unit speeds up tank car unloading and reduces gas loss

Because LP-Gas is a housing necessity in many defense areas, handling equipment that will be made available must be dependable. Brunner LP-Gas self-contained compressor units are a self-liquidating investment that pay for themselves from savings in gas recovered from tank cars unloaded. Brunner units conserve man-power by reducing the time required to unload tank cars. Safe, efficient and economical, Brunner is the answer to liquid petroleum gas handling problems. Brunner Manufacturing Co., Utica, N. Y., U. S. A.

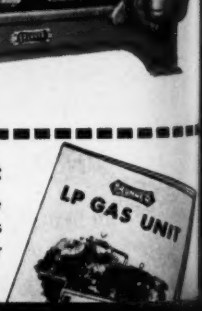


Brunner LP-Gas self-contained compressor . . . heavy duty 4 cylinder, 5 h. p. unit.

ARMY E NAVY BRUNNER

Write for FREE Booklet

The new booklet describes the Brunner LP-Gas Unit, contains illustrations, diagrams and other pertinent facts on handling liquid petroleum gas.



RESEARCH

• **EACH MONTH a competent staff reviews more than 70 publications serving the oil, gas and affiliated industries in a search for those published articles of value to technicians and executives in the liquefied petroleum gas industry. In this department of** BUTANE-PROPANE *News*, **brief abstracts of such articles are presented.—Editor.**

Some Uses of Infra-Red Spectroscopy For Hydrocarbon Analysis—R. Robert Brattian. *California Oil World*, Second Issue, Jan. 1943, Page 9. Three different types of energy change within a molecule give rise to its spectrum. Changes in the electronic energy of a molecule cause either emission or absorption of radiation in the ultra-violet or visible regions. In general the spectra of two molecules will be different when any of the three following conditions exist: 1. The molecules contain different atoms (methane and chloromethane). 2. The molecules contain the same atoms but the bonds between them are different (butane and butylene). 3. The molecules contain the same atoms held together by the same forces but the atoms are in different relative positions (n-butane and isobutane).

Certain Aspects of Cooling Tower Design and Operation—Raymond C. Kelly. *California Oil World*, Second Issue, Dec. 1942, Page 13. Although industrial water cooling has apparently progressed through definite stages in the use of cooling ponds, spray ponds, spray coolers, atmospheric deck-type towers and mechanical draft type towers, it cannot be conclusively stated that any one method is universally better than the others. Rather, each has its own application and relative advantages and disadvantages. To analyze these relative merits and at the same time develop a background for the discussion of the comparison of atmospheric and mechanical draft towers, certain data for cooling ponds, spray ponds and spray coolers are discussed.

New Light on Crank Case Oil Dilution—R. G. Lovell, *Petroleum World*, Dec. 1942, Page 54. The use of a gaseous fuel such as butane necessitates consideration of certain concepts of lubrication which are altogether different from those applying to an engine using an atomized liquid fuel such as gasoline or a liquid fuel by solid injection, as in a Diesel.

Chemical Utilization of Natural Gas, Natural Gasoline Hydrocarbons by Oxidation—Hooper Linford. *Petroleum Engineer*, Jan. 1943, Page 89. Although the petroleum industry controls the cheapest source of hydrocarbon raw material, seemingly it has been slow to capitalize upon the fact. Stabilized natural gasoline is usually considered to consist of a mixture of the saturated paraffin hydrocarbons from the butanes to the octanes (C_4 to C_8) although it is usually found to contain small proportions of some of the higher molecular paraffins. The composition of natural gasoline varies with the source and it is often found to contain varying small proportions of aromatic hydrocarbons such as benzene, toluene and xylene, as well as nathene hydrocarbons such

as cyclopentane and cyclohexane and their simpler derivatives. Natural gasoline is used for blending in the preparation of motor fuels where it has particular value because of its low boiling point range and its rather high knock rating and lead susceptibility.

Vapor-Pressure Chart for Volatile Hydrocarbons—R. Vincent Smith. Information Circular of U. S. Bureau of Mines (I. C. 7215). Aug. 1942. While studying the physical properties of petroleum oils and natural gases in the laboratories of the Bureau of Mines, Bartlesville, Okla., the writer frequently had to refer to published data on the vapor pressures of volatile hydrocarbons. As such data are scattered widely throughout the literature, often not readily available, and frequently referred to uncommon units of pressure and temperature, an attempt was made to collect them, refer them to commonly used units of pressure and temperature, and arrange them on a chart that could be used conveniently in the laboratory. A copy of the writer's chart is included, as it is the nucleus of this report. The ranges of pressures and temperatures are those commonly used in studies requiring data on vapor pressures and boiling points of hydrocarbons from methane to n-dodecane.

"Small Retailers Face the War"—Prepared by *U. S. Dept. of Commerce*, 1942. All phases of the impact of the war on small business—manufacturing, wholesaling, retailing and service establishments—are discussed in an overall picture, with graphic illustrations and statistical tables projecting the picture into 1943. The pressures and squeezes of a wartime economy on small retailers, by far the most numerous group, are treated exhaustively and impartially, together with constructive recommendations designed to ease the burdens imposed by war on this largely important group. Copies of this monograph can be obtained from the Superintendent of Documents, Washington, D. C., (Committee Print No. 13) for 15 cents per copy.

Mathematical Correlation of the Paraffins—Paul Buthod, Lucile Rowell, Edward Stewart, Jr., and Prof. Walter S. Foster. *Oil and Gas Journal*, Oct. 1, 1942, Page 38. Vapor pressures of the lighter hydrocarbons are extremely useful in engineering design work but most such data are presented in a graphical or tubular form. Curves are widely used but it is difficult to obtain accurate readings from them. The tabular form, though more accurate, requires interpolation or even extrapolation in some instances. The purpose of this study is to prepare an empirical equation of vapor pressure versus temperature, by using the method of least squares. A correlation was made between the coefficients obtained in the empirical equations and the number of carbon atoms in the respective hydrocarbons.

War Demand Assures Steady Refinery Operations—H. Stanley Norman. *Oil and Gas Journal*, Jan. 28, 1943, Page 78. Minimum crude oil runs to stills in 1943 must be maintained at approximately 3,800,000 bbl. daily in order to manufacture the products indispensable to the war program. Static as this figure appears to be—reasonable fluctuations are assumed—the revolutionary changes in operations facing the manufacturing branch of the industry cause the maladjustments, incompatibilities of certain government directives and the swings in economics in 1942 to appear subordinate in comparison.

"Should auld acquaintance be forgot...?"

NO SIR! Though we're doing 100% war work right now, 15,300,000 Americans are reading about the TAPPAN Range—in LIFE, WOMAN'S HOME COMPANION, LADIES' HOME JOURNAL and McCALL'S. We are telling them over and over again about the merits and advantages of Tappan Ranges—the Tappans now giving complete satisfaction to owners—and the Tappans you will offer your customers after the war. The Tappan Stove Co., Mansfield, Ohio.

We're sending them straight to YOU by offering the new Tappan Owner Service Book . . . free at Tappan dealers. We're telling them to buy War Bonds today . . . to save for a Tappan tomorrow!

Remember the good auld Tappan days! We're making sure that they'll be *back!*

TAPPAN *Ranges*

Details of Order L-182 On Commercial Cooking Equipment

Some of the provisions of Order L-182, which became effective Oct. 1, and which controls non-electric cooking equipment used in restaurants, hotels, etc., are:

Manufacturers of some types of equipment must cut their use of iron and steel by 75%, based on 1941 production, for both new equipment and repair parts.

Government orders are excepted.

Production of other specified types of such equipment is prohibited.

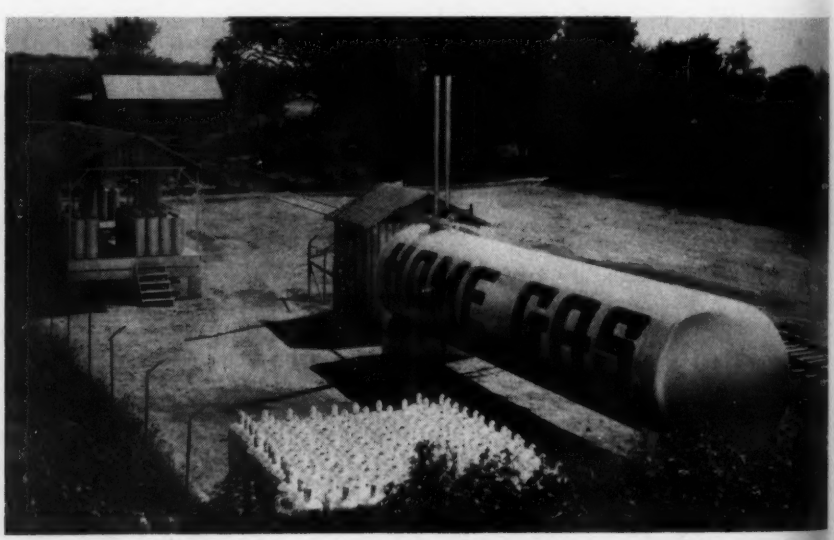
Sales of cooking equipment—both new and used—to restaurants, cafeterias, cafes, and similar establishments is prohibited except with specific authorization of the Director General for Operations. It was pointed out that authorizations will be granted only in the most essential cases. The authorization must be applied for on Form PD-638 A.

The order (L-182) restricts use of iron and steel in such items as bakers, broilers, fryers, griddles, grills, hot plates, ovens (except built-in types), ranges, roasters, steamers, toasters, urns and warmers. Only equipment operated by coal, wood, oil, gas, or other non-electric fuel is covered. Household cooking appliances are not affected.

Production and delivery of electrically-operated cooking equipment has been restricted previously.

One section of the order allows ultimate consumers of cooking equipment to resell it to dealers, distributors or manufacturers without restriction.

Manufacturers, distributors, and dealers must file reports of inventories with the WPB on the tenth of each month on Form PD-638.

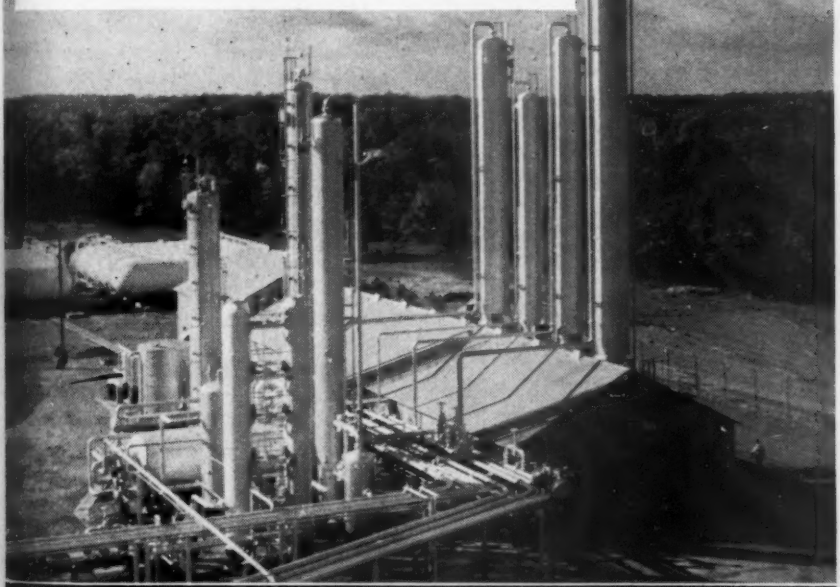


The Mankato, Minn., plant of the Home-Gas Co. Both Pressed Steel Tank Co. and Scaife Co. cylinders are shown in the picture.

WARREN
LIQUEFIED PETROLEUM GAS

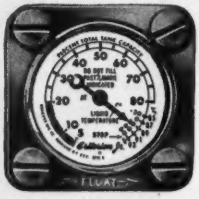
Warren's Butane and Propane are playing a vital part in America's Victory Program; for making 100-Octane Aviation Gasoline; for processing many kinds of war materials. Yet, through increased production and facilities, we are able to take care of all of our valued customers.

You can depend upon Warren.



WARREN PETROLEUM CORPORATION

Tulsa, Oklahoma



LONG WILL THEY SERVE!

. . . that's because Rochester Gauges are carefully designed and durably built to serve with greater accuracy and dependability throughout the present emergency.

ROCHESTER MFG. CO., INC.
17 Rockwood St., Rochester, N. Y.

ROCHESTER
Criterion **GAUGES**

For Safety
and Economy

ETHYL MERCAPTAN

Purified

The ACCEPTED standard odorant for liquefied petroleum gases.

MALLINCKRODT CHEMICAL WORKS

ST. LOUIS NEW YORK

New Officers Are Elected To American Meter Co.

At a recent meeting of the board of directors of American Meter Co. Norton McKean was elected president to fill the vacancy caused by the recent death of Francis H. Payne.

Norton McKean

J. C. Diehl

Elected vice presidents were John C. Diehl, formerly chief engineer, with headquarters in Erie, Pa., and Arthur E. Norton, formerly manager of the company's factory in Boston. Mr. Diehl was also appointed to serve as manager of the Metric Metal Works plant in Erie, Pa. A. McW. Wolfe, the assistant manager in Boston, was promoted to the managership of the Boston plant serving New England.

Calvin A. Nichols, controller and assistant treasurer, has been made acting treasurer. Arthur F. Benson, formerly assistant chief engineer, was promoted to chief engineer of the company. Robert O. Borden has been promoted to assistant manager.

Mr. McKean first joined American Meter Co. in July, 1913 in Boston, Mass. He advanced to several positions of responsibility before he was made manager of the Albany plant in January, 1928. He has been a director since April, 1932; became general manager in 1936, vice president in 1937, and treasurer in 1938.

RELIANCE REGULATORS

ARE DESIGNED AND TESTED TO MAKE L-P GAS BEHAVE

A Reliance Regulator will make gas behave in every conceivable regulating application in the liquid petroleum industry. The wide range of sizes with many variations of Reliance Regulators provide positive and uniform control for all pressure conditions in L-P gas lines.

Since the birth of the L-P gas industry, Reliance Regulators have been preferred for their originality of design, by which positive lock-up and absolute control of steady outlet pressure are assured under variable loads and inlet pressures.

Simplicity reduces installation costs, minimizes maintenance service, reduces size and weight and saves metal for the war effort. To make your L-P gas system behave, install Reliance Regulators.

BULLETINS ARE AVAILABLE ON THE COMPLETE LINE OF APPROVED RELIANCE REGULATORS.

AMERICAN METERS

RELIANCE REGULATORS

RELIANCE REGULATOR CORPORATION
1088 MERIDIAN AVENUE, ALHAMBRA, CALIFORNIA

Carter Oil Awards 40-Year Service Button to H. F. Miller

H. F. Miller, manager of the marketing department of The Carter Oil Co., Tulsa, Okla., was presented with a "40-year button" on Dec. 3 in honor of his two-score years of association with the company.

H. F. MILLER

Mr. Miller was born in Brooklyn in 1886. In 1907 he entered the employ of the Anglo-American Oil Co., Ltd., of London, as a clerk in their New York office, and two years later he became secretary to Walter C. Teagle, former Standard Oil Co. (New Jersey) president, and until recently chairman of the board.

As secretary to Mr. Teagle, Mr. Miller was with the Anglo-American Oil Co. until 1910, Standard Oil Co. (N.J.) from 1910 to 1914; Imperial Oil Co., Ltd., of Toronto, Canada, from 1914 to 1917, and back with Standard Oil Co. (N.J.) from 1917 to 1921.

Mr. Miller went to Tulsa in 1921 as a purchaser of petroleum products, principally gasoline, for Standard. He was made head of The Carter marketing department in 1932 when the department was organized, and elected a member of the board of directors in 1933, now serving in both capacities.

◆ ◆

A 24-Tank Testing Pit Features New Dallas Plant

In recently completing its fourth major building construction project since 1938 Dallas Tank & Welding Co., Inc., has put under roof a total of 33,882 sq. ft. of space on more than four acres of ground. The entire plant is fenced in by a 7-ft. wire mesh fence.

The latest addition to the plant covered the erection of a 93 x 180-ft. used building that had been purchased in good condition in the state of Georgia.

The new building is equipped with a 5- and a 10-ton electricly operated, overhead, traveling crane, a new square shear cutting machine 10 ft. long by ⅜-in. cutting capacity and a ⅝-in. capacity bending roll for rolling shell sections up to ⅝ in. in thickness and an automatic acetylene and oxygen cutting machine which cuts up to 24 in. in thickness.

The floor of the new building is of 5-in. concrete with concrete foundations.

The new building also accommodates a 20,000-gal. underground testing pit. A total of 24 tanks can now be tested at one time by the company. The company also operates a total of 27 electric welding machines. W. W. Banks is president.

◆ ◆

New Vice Presidents Named For Shell East of Rockies

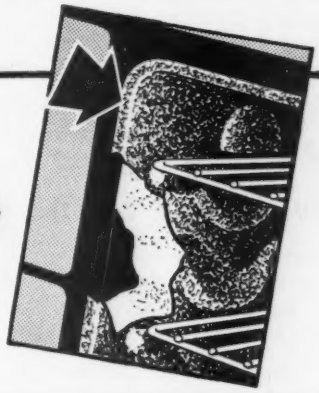
The appointment of J. F. M. Taylor and H. Bloemgarten as vice presidents of the Shell Oil Co., Inc., east of the Rockies, effective Jan. 1, was announced Dec. 31 by Alexander Fraser, president of that company.

Mr. Taylor as vice president of manufacturing, succeeds E. D. Cumming, who has been granted an indefinite leave of absence and was recently appointed director of refining under the Petroleum Administrator for War.

Mr. Bloemgarten, who for the past year, has been special assistant to the president in exploration and production operations, will continue to deal with this phase of the business.

A Chip Off the Old Block

...BUT BETTER



The last Caloric off the lines before all-out war production contained this feature.

Many ordinary pre-war ranges had a crack where the oven lining joined the front frame of the range. The Caloric oven lining, on the other hand, extended completely *outside* of the oven frame, as shown in this block. The oven door actually came into contact with it when closed. No possibility of unsanitary conditions or impaired insulation efficiency.

The first Caloric off the lines after the war will contain this feature.

The feature that fills this block tomorrow will be a chip off the old block—a *finer* feature of far-reaching significance in the gas range field. Caloric engineers and designers are putting their heads and skills together *today* to develop it. Yes, even though Caloric's entire plant is now producing for war, Caloric research continues...working to "cook up" a finer Caloric—one that will continue the tradition of this gas range as the finest ever built in America.

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Send your old regulators to us. We will replace worn or broken parts, test for leaks and pressure setting, and send them back to you as good as new.

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meets the demands of the nation. Our plant has gone to war for the duration — but when peace comes, L. C. RONEY products for the LP-Gas industry will meet the demands of dealers everywhere. In the meantime—our stock of LP-Gas equipment is still complete.

L.C. RONEY INC.
1044 E. 59th ST. · LOS ANGELES, CALIF.

CNGA Issues New Preface On Testing Procedure

The use of two tests in obtaining a better relationship to plant production became standard practice in the California natural gasoline industry Feb. 1. Revisions are contained in the preface to Bulletin TS-351, "Tentative Standard for the Charcoal Test for the Determination of Gasoline Content of Natural Gas," which was approved by the executive committee of the California Natural Gasoline Association, Jan. 19.

"Recently," says the new preface, "the industry has been required to manufacture natural gasoline products of widely varying vapor pressures including liquefied petroleum gases. The allocation of these products for royalty settlement purposes may be accomplished by the application of the 30-lb. 32° F. and the rectified test results.

"The use of these two test results for royalty-allocation purposes must consider the quality of the individual gases and their relationship to the quality of the plant production. For this reason the use of the average of the 30-lb. 32° F. and the rectified-charcoal test results is recommended to produce a better relationship of the test yield to the plant production when natural gasolines containing substantially all the isobutane and heavier hydrocarbons with or without some propane are produced.

"Stabilized natural gasolines of lower vapor pressures, composed predominately of pentanes and heavier hydrocarbons may be allocated on the basis of rectified charcoal-test yields.

"The use of the 30-lb. 32° F. test results, the rectified-test results, the average of the two test results or a combination of the results for allocation purposes will depend upon contractual requirements and the particular distribution problems involved."

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Handbook

BUTANE-PROPANE GASES

481 Pages of Up-to-Date LP-Gas Information, Charts, Diagrams and Photographs **$5.00**

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Chapter 2. Properties of Butane-Propane Mixtures.

Chapter 3: Volume Correction Factors.

Chapter 4: Analytical Determination and Testing.

PART 3. PRODUCTION OF LP-GAS

Chapter 1: Natural Gasoline Plants, Recycling Plants, Oil Refineries.

PART 4. TRANSPORTATION AND STORAGE

Chapter 1: Delivery by Truck, Rail, Water, and Pipe Line.

Chapter 2: Storage Tank and Pressure Vessel Design.

Chapter 3: Liquid Metering and Pumping Systems.

PART 5. DISTRIBUTION OF LP-GAS

Chapter 1: Installing and Servicing LP-Gas Systems.

Chapter 2: Semi-Bulk Systems.

Chapter 3: Bottled Gas Systems.

Chapter 4: Gas Utility Service From Central Plants.

Chapter 5: Multiple Utility Service From a Central Plant.

PART 6. UTILIZATION OF LP-GAS

Chapter 1: Comparative Performance With Other Fuels.

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Chapter 3: Domestic Applications.

Chapter 4: Commercial Applications.

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Chapter 6: Enrichment, Peak Load and Standby Uses.

Chapter 7: A Fuel for Internal Combustion Engines.

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Section 1: N.B.F.U. Pamphlet No. 58.

Section 2: Motor Carrier Regulations.

Section 3: Freight Regulations.

Section 4: Unloading Tank Cars .

Section 5: Marine Regulations.

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Section 1: Products Liability Insurance.

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A comprehensive presentation of LP-Gas appliances and equipment by the manufacturers of the LP-Gas industry's best known products.

We pay postage on orders accompanied by check or money order. In California add 3% for sales tax. In Canada add 10% for excise tax.

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We are not forgetting

Though we have converted all our facilities to war production, we are not forgetting our customers in the LP-Gas industry.

When the war is won we shall do everything to maintain our reputation as manufacturers of first quality LP-Gas equipment.

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Insulating Product Saves Gas And Boosts Dealers' Income

A way to provide supplemental business for his 75 local dealers throughout Oklahoma and at the same time to assist the Government in saving fuel has been found by L. H. Hughes, owner, Oklahoma Automatic Gas Co., of Oklahoma City, Okla.

Mr. Hughes announces that his company has acquired a factory at Dallas, Texas, and state agencies for Oklahoma and Texas to sell "Insul-Wool," a house insulating product. The material will be sold through local dealers of the Oklahoma Automatic Gas Co., as rapidly as arrangements can be completed with them.

The material can be furnished on terms approved by the FHA which will make the financing easy, Mr. Hughes says. "Most of our local dealers are in the hardware, furniture or some other type of business in connection with their agency to handle LP-Gas appliances and equipment" Mr. Hughes states. "Of course wartime restrictions have slowed down their appliance and equipment sales but our new line will assist them in bridging the gap for the duration of the war, we hope, and put them in better condition to continue a good job in the LP-Gas business after the war."

Mr. Hughes says that customers of his company are cooperating willingly and understandingly in the program for conserving rubber and other unnecessary waste. He states that they permit his drivers to fill their tanks whenever they are in the territory and refrain from waiting until they are out of gas, as many of them did before the war, and then send in calls for hurry-up delivery and that through such co-operation he is saving as much as 50% on delivery calls.

IT'S WAR Today

and although our major effort is confined to the war program, our engineering and research staffs are working and looking ahead to tomorrow's peace, when we will again be able to meet your requirements without first asking your priority rating—when we can give you the benefit of the many new manufacturing materials and methods now being used for war production.

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Everybody Can Help The Scrap Movement

Citizens throughout the country are asked by the Conservation Division, War Production Board, to act as "salvage scouts" to search out and report idle iron and steel structures and any large amounts of abandoned machinery or metal equipment, wherever they exist. It is in many different forms—abandoned bridges, mines, buildings, railroad and street rails, saw mills, tanks, sunken ships and in a great many other forms.

Often a suggestion to the owner is all that is necessary to start the metal moving to the mills. Any person who knows of idle metal in any form is requested to send information concerning the nature, location, and, if possible, the ownership of such equipment to the Special Projects Salvage Section, War Production Board, Washington, D. C.

◆ ◆

Special Agreements Will Now Determine Storage Prices

Prices for services rendered by oil companies in storing and distributing high octane aviation gasoline for the Army and Navy may be determined through agreement between the oil companies and the War and Navy Departments, the Office of Price Administration has announced.

The prices must be reported to the OPA within 10 days of the agreement, and if they are not disapproved or modified by OPA within 30 days, they will be accepted as maximum prices.

◆ ◆

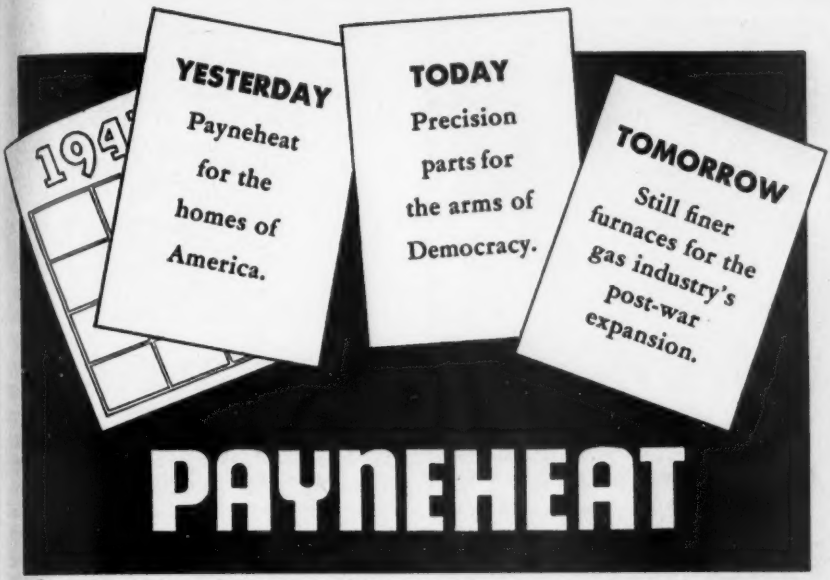
Large Skelgas Plant Serves Minnesota Resort Area

The Skelgas Division of Skelly Oil Co., has recently completed at Detroit Lakes, Minn., in the resort and playground section of that state, the bulk plant shown in the accompanying picture. The tank is of 20,000-gal. capacity. Propane is distributed. The warehouse is 100 feet long and the plant can handle from 400 to 500 cylinders per day.

The plant sells only at wholesale. It was completed in January of 1942 and is managed by Orie Heard.

This plant is one of 21 operated by the Skelgas company and one of five plants which the company maintains in Minnesota.

The 20,000-gal. bulk plant of the Skelly Oil Co. at Detroit Lakes, Minn.



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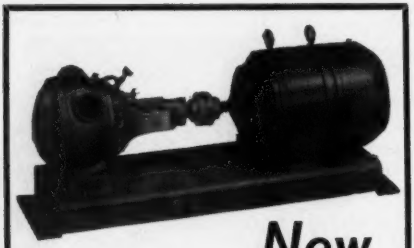

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meet every requirement. The balanced gear construction of SMITH Butane-Propane PUMPS reduces internal wear. Fluid sealed packing box makes hazardous gas leaks impossible.

Order Model 211 for truck mounting.

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YOUNGSTOWN, OHIO.

Calculation Methods for High Pressure Gas Measurement

Just off the press is the first publication of the High Pressure Gas Division of the Natural Gasoline Association of America. It is entitled, "Tentative Standard Methods for Calculation of High Pressure Gas Measurement," and is the result of more than an entire year of study by this division, which is under the direction of C. R. Williams, NGAA vice president.

Part 1 presents a tentative standard for obtaining orifice correction factors to account for the deviation of gases from ideal gas laws at high pressure. This factor has been combined with the gravity and temperature factors to simplify the calculation of the meter quantity since both the gravity and temperature are required to determine the compressibility factor.

Part 2 presents the details of an investigation of the reliability of the compressibility factor method for gas density calculations and compares the experimental and calculated compressibility factors on a number of natural gases.

Copies of the publication are available for 50 cents each. The price is 45 cents for from 10 to 24 copies and 40 cents for 25 or more. Address the association at 922 Kennedy Bldg., Tulsa, Okla.

◆ ◆

J. A. Krug Is Named Power Administrator

A former TVA official, J. A. Krug, was named the country's power administrator Jan. 22.

Mr. Krug was appointed by Chairman Donald M. Nelson of the War Production Board as head of a new office of power director, responsible for electricity, gas, water and communications.

HELPFUL INFORMATION ON

REZNOR UNIT HEATERS

Reznor has manufactured gas heating equipment exclusively since 1888. This solid foundation of long and broad experience enabled the company to develop and build outstanding features in its gas fired unit heaters. Reznor Units are available in 3 types and 9 sizes. No other type of equipment can be installed as quickly, and at the same time, 89% of vital materials is saved. Reznor Gas Fired Heaters also move more warm air over wider areas. Catalog U 42 tells with descriptive pictures and words how and why Reznor equipment will operate to advantage for you.

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It can be *only* the fabricator who has the very specialized knowledge and experience required to design and construct tanks for this service . . . Safety and satisfaction depends upon his specifications for materials and choice of procedure for handling them.

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WELDED and RIVETED PRODUCTS

PROPANE TANKS FOR UNDERGROUND OR ABOVE-GROUND STORAGE

ANSWERS

To Chapter 17
The Bottled Gas Manual

Here are the answers to the questions on Page 40 and which refer to problems in Chapter 17 of THE BOTTLED GAS MANUAL:

1. By weight.
2. Five cords of white oak would provide 5×17,783,-953=88,919,765 B.t.u.; one cord of white pine wood would provide 9,343,296 B.t.u.; 88,919,765 divided by 9,343,296 = 9.5 cords plus.
3. Coal, oil, wood, electricity.
4. Carbon, hydrogen, oxygen, nitrogen and ash.
5. 69.12 cu. ft.
6. When water is not a product of combustion.
7. A. Reduce temperatures to their proper level.
   B. Install a propane heater that is balanced to the job.
   C. Locate the propane heater properly in relation to the job.
   D. Use thermostatic controls.
   E. Stop heat losses by the use of insulation.
8. 11.76 cents per lb.
9. Chimney fires, overheated woodwork, sparks or coals, explosions.
10. One hundred pounds of propane contain 100 x 21,633=2,-163,300 B.t.u. 60% of 2,163,300 = 1,297,980 B.t.u. which is the amount of heat necessary to do the job. One cord of red maple wood contains 12,673,-013 B.t.u. 1,297,980 divided by 12,673,013 = 10.2% plus.

N. H. Schumacher, Gas Equipment Co., Inc., Dallas, Texas, is shown releasing Hackney cylinders for shipment through D. C. Hall Motor Freight Line to Hydro Gas Co., of Bainbridge, Ga., where they will be installed at a U. S. flying school. The cylinders are equipped with Bastian-Blessing Rego equipment. The order covering the cylinders bore an AA-4 rating. W. Guy McKenzie is president of Hydro Gas Co.

◆ ◆

Figures Corrected For 1942 LP-Gas Sales

The review published on Pages 18-24 of the January issue of BUTANE-PROPANE *News* under the title of, "Industry Marches to War Tempo," contained a discrepancy on the estimated marketed production in 1942. Text of the story carried the figure at 548,000,-000 gal., an increase of 10 per cent and Table 1 showed this item at 555,-000,000 gal., a gain of 20.1 per cent.

G. G. Oberfell, vice president of Phillips Petroleum Co., author of the liquefied petroleum gas review, advises the tabulated figure of 555,-000,000 gal. is correct.

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LPG Dealers find real profit in BRILLIANT FIRE sales because the product is time-tested, trustworthy. Geared for economy operation and negligible servicing. These popular heat-makers are offered in a variety of styles for every home need.

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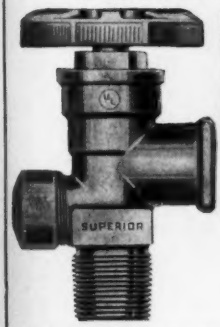

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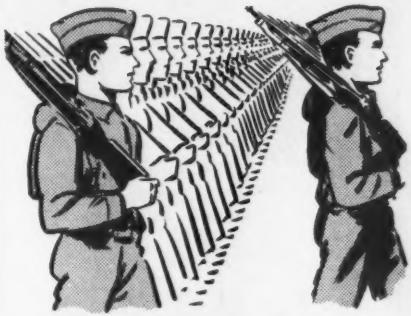

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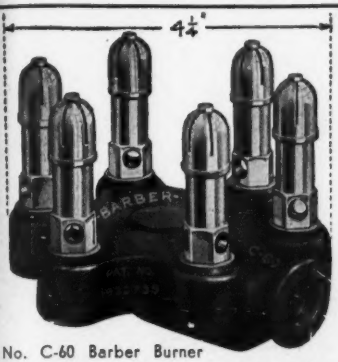
Oxygen and Calcium Carbide Shortages Are Expected Soon

Shortages of both oxygen and calcium carbide are anticipated during the early part of this year, members of the Oxygen and Acetylene Industry Advisory Committee were told at a meeting in Washington in January.

A recent survey of oxygen requirements compared with oxygen production indicates a serious shortage during the first half of 1943, government representatives told the members. This shortage may be aggravated and prolonged, depending upon the completion of new plants under construction. Members were asked to advise the Chemicals Divisions of places where conservation measures can be applied and where consumption can be reduced with the least hindrance to the war effort.



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Barber is now working on war production, but wherever possible and permitted, we are still supplying the regular trade. Barber Units, in many standard or special shapes and sizes, are always correctly designed to fit the individual appliance, and give complete combustion on Butane-Propane or any other gas. Now that efficiency is more vital than ever—submit your burner problems to us. Complete catalog on request.

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In making suction and discharge pipe connections on a Viking Rotary Pump be sure that no strain is imposed on the pump casing by the pipe. Properly installed, the shaft of a Viking pump should turn easily by hand. If this is not possible you have either sprung the pump in making the pipe connections or with the foundation bolts.

For valuable help in installing, operating and maintaining your pumps, write today for your FREE copy of the Viking Service Manual. It's a handy, illustrated booklet filled with practical information. Get EXTRA wear out of your pumps by giving them EXTRA care. The Viking Service Manual tells you how.

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